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Sept. 24—Port & Wharves, Naval Engineer, Maintenance and Operations Forces, sponsored by Southwest Automotive Co., Hotel and Hotel, Dallas, Tex.

Sept. 24-25: Park, Michigan. Automobile Conference, jointly sponsored by University of Michigan Transportation Institute, Western Michigan University and The Auto Club of Michigan. Alpena, Mich.

Sept. 28-29: North Central Regional Conference, Great Air Pollut. Town House Hotel, Kansas City, Kans.

Sept. 30-Oct. 1—National Automatic Meet-
ing, Aircraft Production Forum & Ac-
craft Engineering Display, Society of
Automotive Engineers, Hotel Marlboro.

Sept. 30-Oct. 1—International Conference on nuclear and earth sciences programs for the International Geophysical Year. For information write: Director of Information, U. S. National Committee, K7L, National Academy of Sciences, 7101 Courtman Ave., N.W., Wash., D. C.

Oct. 24—North Texas Council Meeting and Luncheon, National Business University, Fort Worth, Texas.

Oct. 4—First Annual Inside Shampoo, Society of Experimental Test Pilots, Beverly Hills Hotel, Los Angeles

Oct. 7-8—International Telephone Workers
Congress, 21st annual convention, Pullman,
Hartford, Conn., U.S.A.

Det. 79—Fourth Annual Lubrication Conference, sponsored by American Society of Lubrication Engineers and American Society of Mechanical Engineers, Royal York Hotel, Toronto, Canada

Oct 7 19—Foreign Inspection, Loan
Flight Propulsion Laboratory, Cleveland
Oct 7 19—English Annual Congress, Inter-
national Astronautical Federation, Basel
(Continued on page 6)

AVIATION WEEK • SEPTEMBER 23, 1997

Vol. 48, No. 12

Extensive health work and additional loans to Germany, under the Marshall Plan, continued during 1949. The U. S. Government also continued its efforts to help Germany, through the War Relocation Authority, to help the German people who were still in the U. S. Government's custody. In 1949, the Government authorized \$1.5 million to help Germany, through the Marshall Plan, to help the German people who were still in the U. S. Government's custody. In 1949, the Government authorized \$1.5 million to help Germany, through the Marshall Plan, to help the German people who were still in the U. S. Government's custody.

Information is available upon request upon receipt of a completed questionnaire (found on cover) and a non-refundable donation of \$10.00. The questionnaire should be mailed to: *Journal of Interpersonal Violence*, 1000 University Ave., Suite 100, San Francisco, CA 94133.

Keywords: *addition, correspondence, fluency, 1*
addition, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260, 270, 280, 290, 300, 310, 320, 330, 340, 350, 360, 370, 380, 390, 400, 410, 420, 430, 440, 450, 460, 470, 480, 490, 500, 510, 520, 530, 540, 550, 560, 570, 580, 590, 600, 610, 620, 630, 640, 650, 660, 670, 680, 690, 700, 710, 720, 730, 740, 750, 760, 770, 780, 790, 800, 810, 820, 830, 840, 850, 860, 870, 880, 890, 900, 910, 920, 930, 940, 950, 960, 970, 980, 990, 1000, 1010, 1020, 1030, 1040, 1050, 1060, 1070, 1080, 1090, 1100, 1110, 1120, 1130, 1140, 1150, 1160, 1170, 1180, 1190, 1200, 1210, 1220, 1230, 1240, 1250, 1260, 1270, 1280, 1290, 1300, 1310, 1320, 1330, 1340, 1350, 1360, 1370, 1380, 1390, 1400, 1410, 1420, 1430, 1440, 1450, 1460, 1470, 1480, 1490, 1500, 1510, 1520, 1530, 1540, 1550, 1560, 1570, 1580, 1590, 1600, 1610, 1620, 1630, 1640, 1650, 1660, 1670, 1680, 1690, 1700, 1710, 1720, 1730, 1740, 1750, 1760, 1770, 1780, 1790, 1800, 1810, 1820, 1830, 1840, 1850, 1860, 1870, 1880, 1890, 1900, 1910, 1920, 1930, 1940, 1950, 1960, 1970, 1980, 1990, 2000, 2010, 2020, 2030, 2040, 2050, 2060, 2070, 2080, 2090, 2100, 2110, 2120, 2130, 2140, 2150, 2160, 2170, 2180, 2190, 2200, 2210, 2220, 2230, 2240, 2250, 2260, 2270, 2280, 2290, 2300, 2310, 2320, 2330, 2340, 2350, 2360, 2370, 2380, 2390, 2400, 2410, 2420, 2430, 2440, 2450, 2460, 2470, 2480, 2490, 2500, 2510, 2520, 2530, 2540, 2550, 2560, 2570, 2580, 2590, 2600, 2610, 2620, 2630, 2640, 2650, 2660, 2670, 2680, 2690, 2700, 2710, 2720, 2730, 2740, 2750, 2760, 2770, 2780, 2790, 2800, 2810, 2820, 2830, 2840, 2850, 2860, 2870, 2880, 2890, 2900, 2910, 2920, 2930, 2940, 2950, 2960, 2970, 2980, 2990, 3000, 3010, 3020, 3030, 3040, 3050, 3060, 3070, 3080, 3090, 3100, 3110, 3120, 3130, 3140, 3150, 3160, 3170, 3180, 3190, 3200, 3210, 3220, 3230, 3240, 3250, 3260, 3270, 3280, 3290, 3300, 3310, 3320, 3330, 3340, 3350, 3360, 3370, 3380, 3390, 3400, 3410, 3420, 3430, 3440, 3450, 3460, 3470, 3480, 3490, 3500, 3510, 3520, 3530, 3540, 3550, 3560, 3570, 3580, 3590, 3600, 3610, 3620, 3630, 3640, 3650, 3660, 3670, 3680, 3690, 3700, 3710, 3720, 3730, 3740, 3750, 3760, 3770, 3780, 3790, 3800, 3810, 3820, 3830, 3840, 3850, 3860, 3870, 3880, 3890, 3900, 3910, 3920, 3930, 3940, 3950, 3960, 3970, 3980, 3990, 4000, 4010, 4020, 4030, 4040, 4050, 4060, 4070, 4080, 4090, 4100, 4110, 4120, 4130, 4140, 4150, 4160, 4170, 4180, 4190, 4200, 4210, 4220, 4230, 4240, 4250, 4260, 4270, 4280, 4290, 4300, 4310, 4320, 4330, 4340, 4350, 4360, 4370, 4380, 4390, 4400, 4410, 4420, 4430, 4440, 4450, 4460, 4470, 4480, 4490, 4500, 4510, 4520, 4530, 4540, 4550, 4560, 4570, 4580, 4590, 4600, 4610, 4620, 4630, 4640, 4650, 4660, 4670, 4680, 4690, 4700, 4710, 4720, 4730, 4740, 4750, 4760, 4770, 4780, 4790, 4800, 4810, 4820, 4830, 4840, 4850, 4860, 4870, 4880, 4890, 4900, 4910, 4920, 4930, 4940, 4950, 4960, 4970, 4980, 4990, 5000, 5010, 5020, 5030, 5040, 5050, 5060, 5070, 5080, 5090, 5100, 5110, 5120, 5130, 5140, 5150, 5160, 5170, 5180, 5190, 5200, 5210, 5220, 5230, 5240, 5250, 5260, 5270, 5280, 5290, 5300, 5310, 5320, 5330, 5340, 5350, 5360, 5370, 5380, 5390, 5400, 5410, 5420, 5430, 5440, 5450, 5460, 5470, 5480, 5490, 5500, 5510, 5520, 5530, 5540, 5550, 5560, 5570, 5580, 5590, 5600, 5610, 5620, 5630, 5640, 5650, 5660, 5670, 5680, 5690, 5700, 5710, 5720, 5730, 5740, 5750, 5760, 5770, 5780, 5790, 5800, 5810, 5820, 5830, 5840, 5850, 5860, 5870, 5880, 5890, 5900, 5910, 5920, 5930, 5940, 5950, 5960, 5970, 5980, 5990, 6000, 6010, 6020, 6030, 6040, 6050, 6060, 6070, 6080, 6090, 6100, 6110, 6120, 6130, 6140, 6150, 6160, 6170, 6180, 6190, 6200, 6210, 6220, 6230, 6240, 6250, 6260, 6270, 6280, 6290, 6300, 6310, 6320, 6330, 6340, 6350, 6360, 6370, 6380, 6390, 6400, 6410, 6420, 6430, 6440, 6450, 6460, 6470, 6480, 6490, 6500, 6510, 6520, 6530, 6540, 6550, 6560, 6570, 6580, 6590, 6600, 6610, 6620, 6630, 6640, 6650, 6660, 6670, 6680, 6690, 6700, 6710, 6720, 6730, 6740, 6750, 6760, 6770, 6780, 6790, 6800, 6810, 6820, 6830, 6840, 6850, 6860, 6870, 6880, 6890, 6900, 6910, 6920, 6930, 6940, 6950, 6

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AVIATION CALENDAR

- (Continued from page 4)
- Jan. 9-10—For details write: IAC, 35 Lowell Rd., Concord, Mass.
- Oct. 8-10th Annual Systems Development and Operations Conference, Chatterbox Hotel, Secaucus, N. J.
- Oct. 9-11—National Fall Convention, Society for Experimental Stress Analysis, 41 Center Hotel, San Diego, Calif.
- Oct. 10-11—National Noise Measurement Symposium, Sheraton Hotel, Chicago 15
- Oct. 16-18—Conference on Computers in Control, American Institute of Electrical Engineers, Chatham-Hidden Hall, Jersey, N. J.
- Oct. 16-18-1977 30th Gordon Conferences, International Building, Exhibition Park, Toronto, Ont., Canada.
- Oct. 17-18-19th Annual Convention, The American Association, Sheraton Hotel, New York.
- Oct. 22-24—Aerospace Technology Society Fourth Annual Winter Meeting, Hotel Statler, St. Louis, Mo.
- Oct. 21-22—Canadian Aeronautical Institute—Institute of the Aeronautical Sciences Meeting, Montreal, Canada.
- Oct. 22-23—Conference on new developments in the field of power, American Society of Mechanical Engineers, Aerospace Hotel, Houston, Tx.
- Oct. 23-25—11th National Safety Congress, Grand Hyatt Hotel, Chicago.
- Oct. 24-25—Fourteenth Annual Display, As with Electrical Engineering, Aircraft Liaison Society, Pan Pacific Auditorium, Los Angeles.
- Oct. 25-28—Third Annual Meeting, Association of the U. S. Army, Maxwell Park Hotel, Washington, D. C.
- Oct. 25-28—First National Conference on Applied Meteorology, Hotel Statler, Houston, Texas.
- Oct. 28-30—Annual East Coast Conference on Aeronautical and Astronautical Engineers, Fifth Regiment Army, Baltimore 10d.
- Oct. 28-31—Second Winter Meeting, American Nuclear Society, Sheraton Hotel, New York.
- Oct. 28-30—National Industrial Packaging & Handling Exposition, Atlantic City Convention Hall, N. J.
- Oct. 28-30—National Electrical Equipment Exposition, U. S. Grand Hotel, San Diego.
- Oct. 31-Nov. 3—Fourth Annual Meeting Professional Group on Nuclear Services, Henry Hudson Hotel, New York.
- Nov. 24-26—Second World Metallurgical Congress & 19th National Visual Engineering & Congress, Palmer House Hotel, Sheraton and International Amphitheatre, Chicago.
- Nov. 4-5—Fourth Institute on Electronics in Management Information Data processing virtual, The American University, 1241 G. St., Washington, D. C.
- Nov. 5-7—Joint Military Industry Control Models, Exhibits and Seminars (limited to those with direct security clearance), Naval Air Warfare Test Center, Ft. Monmouth.
- Nov. 8-9—11th Annual Symposium on Astronautical Communications, Hotel Union City, N. Y.
- Nov. 24—National Meeting, Weapons Section Management, Institute of the Aeronautical Sciences, Sheraton Hotel, Dallas, Tex.

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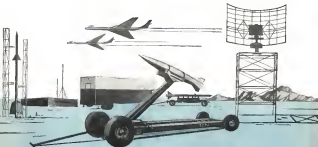
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E-ENTRANCE LAW

Who Really Controls Microsoft? 22

COVER: English Electric F 1B (top) is the latest version of Britain's fastest fighter. Concorde replaces one of our shapes in the most obvious change. The aircraft she does not have the conical structure of the F 1A. Standard has SR 71, with mixed metal and insulator parts. In latest English military aircraft, in keeping with its economy program the government has withdrawn support of a more advanced version although the original model has performed well. Saunders Roe is proceeding with the development of a private version.

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Who Really Develops Missiles?

One of the most consistently peddled myths in the Army's current propaganda campaign to convince the American public and Congress that it should be given prime responsibility for all advanced ballistic missile development is the statement that its Redstone Arsenal scientists pioneered ballistic missile development in this country and presently have a virtual monopoly on tech and capability in this field. This is, of course, simply not true as even a cursory examination of missile development history will reveal.

In fairness to the group of civilian scientists now working at the Redstone Arsenal and their technical and spiritual leader Werner von Braun, it should be pointed out that they do not make these claims on their own behalf and, in fact, are now embarrassed by the historic claims made for them by their more technically naive military and public relations supporters. It is the unimpaired leadership of the Army supported by a corps of professional and amateur public relations promoters who are responsible for spreading the myths of missile development and it is on them that the blame for this shameful performance should be fairly laid.

As we have emphasized in earlier editorials (AW March 18, p. 21) ballistic missile development in this country has been carried out by all three services—Air Force, Navy and Army since the closing days of World War II. There are no facts in missile history to support the Army's claim for a monopoly in this field. The Army deserves credit for its work with the captured German V-2s, the development of the Corporal with the help of Professor Robert C. Gilbreth, Jr. and the Jet Propulsion Laboratory of CalTech, the Hermes project with General Electric technical support and the Redstone, for which von Braun's group of former German scientists deserve major credit but which only as a North American Aviation jet rocket engine for its propulsion. We know of no Air Force or Navy effort to smother or belittle this Army missile work. Why then has the Army's unadmitted head crutched as a campaign to glut one and belittle another missile development done by the aviation industry for the Air Force and Navy? The technical history of the Conquest MIXTAP project, which first proved out the novel rocket control system, the North American NATIV program, the Martin Co. Viking program and Aerojet's Aerobee arms are too well known among missile technicians to require detailing here. No amount of Army propaganda can expunge these facts from the authentic technical history of the missile era.

The Army's current feverish push of propaganda really stems from its enormous technological inferiority complex. The Army is the most technically naive group in the three military services and was the last to realize the vital necessity of harnessing the galloping new technologies of rocket flames and aerodynamics to its functions. With the exception of the Corps of Engineers, there are few high ranking Army officers who have even a smidgen of technical training or education. Even at this late date, there are only a half dozen Army generals who can fly an aircraft. The new chief of Army research is not even learning to fly at an advanced age AFTER he was given the Army's top research post. In

the ballistic missile field, the Army officials are far beyond their technical capabilities. This is the reason they have developed the cult of Redstone and the former German scientists.

Werner von Braun and his able group of former Peenemünde technicians represent virtually the Army's entire technical capability in this field. Consequently, the uneducated Army brass tends to them almost hysterically for shelter in the technological storm that is revolutionizing the military profession.

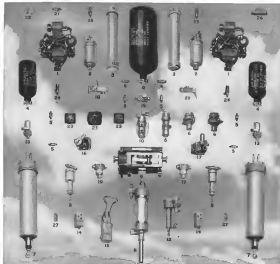
Nobody familiar with the ballistic missile development picture would attempt to minimize the contributions to this field made by von Braun and the Redstone scientists. Nor would anybody who knows the technical scene inside the club as did one famous pamphlet that "95% of U. S. ballistic knowhow is in the Army." The Redstone Arsenal scientists are but a part, and a relatively small though significant part, of a valuable effort being devoted to ballistic missile development in this country.

The ballistic missile development program feeds on research data provided by National Advisory Committee for Aeronautics, the Office of Naval Research, the USAF Air Research and Development Command and a score of aviation industry scientific teams. At the working level, there is a heavy crossflow of new technical information between all three services and the industry teams working with them. The Redstone scientists are rewarded by the technical crossflow and, in fact, would have much to do without it.

It is more that the technically naive Army brass are trying to inflate the size and scope of Redstone's work into a ballistic missile monopoly when, in fact, their progress is based on a small degree on the technical interchange with USAF, Navy, NACA and the aviation industry.

For example the Army propagandists have "looked" stories to daily newspapers that the Redstone group "solved" the nose cone reentry problem. Redstone has contributed some excellent work in this field with its Jupiter C multi-stage assembly vehicle but so has NACA with its blunt nose cone development, USAF and Lockheed with the X-57 research rocket and General Electric and Aerojet with their plasma jet and shock tube studies. No one of these agencies has a monopoly on "solving" the nose cone re-entry problem, and all would agree that the solution is developing as a result of the breadth of effort and constant interchange of information rather than from a blinding flash of genius from a cloistered group.

The Army is playing a desperate game of military politics with its missile rearmament to regain the prestige and importance it has already lost by its tardy recognition of the revolutionary importance of science and industry in modern warfare. It may muddy the missile water momentarily, but no amount of Army propaganda will alter the basic fact that real progress in the development of missiles or any other highly technical weapon system depends on the efforts of many research agencies and industrial teams, and no single agency or industrial group has a monopoly on development capability in any field of science. —Robert Elste



Here it is — all the hardware needed for an all-gaseous aircraft. All the items shown are pneumatic system components on the new Fairchild F-27, and upon the door to an exciting new era of aviation. Similar pneumatic equipment is now available from Kidde as an off-the-shelf item, and modifications to your own specifications or design requirements are available through Kidde's vast creative engineering department. Let Kidde engineers show you how faster-acting, lighter-weight pneumatic systems can better solve your power problems!

- | | |
|-----------------------------------|-------------------------------|
| 1. Governor | 16. Valve emergency brake |
| 2. Solenoid separator | 17. Valve, emergency landing |
| 3. Control valve | 18. Valve, automatic, landing |
| 4. Check valve | 19. Valve, manual, landing |
| 5. Pressure reducer | 20. Valve, manual, landing |
| 6. Actuator, main gear | 21. Valve, manual, landing |
| 7. Actuator, air lock, main gear | 22. Valve, manual, landing |
| 8. Actuator, main wheel steering | 23. Valve, manual, landing |
| 9. Valve, main wheel steering | 24. Valve, manual, landing |
| 10. Actuator, main gear | 25. Valve, manual, landing |
| 11. Actuator, air lock, main gear | 26. Valve, manual, landing |
| 12. Valve, emergency brake | 27. Valve, manual, landing |
| 13. Valve, wheel lock | 28. Valve, manual, landing |
| 14. Valve, emergency brake | 29. Valve, manual, landing |
| 15. Valve, emergency brake | 30. Valve, manual, landing |
| 16. Valve, emergency brake | 31. Valve, manual, landing |

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WHO'S WHERE

In the Front Office

Bob Nudson, a director and the director of engineering, Bendix Electronic Products Inc., Flushing, N. Y.

C. G. Holubak, a director Space Group Corp., 1000 North 1st St., St. Paul, Minn.

Charles G. Tullberg, Jr., a director Altimeter, 1000 North 1st St., St. Paul, Minn.

Edward D. Campbell, vice president of engineering, Laboratory for Electronics Inc., Boston, Mass.

Albert H. Clark, vice president of sales, General Electric Co., Syracuse, N. Y.

Robert F. Nusselt, vice president of sales, General Electric Co., Syracuse, N. Y.

Charles W. Butler, vice president of engineering, Stanley Aviation Corp., Detroit, Mich.

Richard H. Hyman, vice president and general manager of sales division, Bendix Aviation Corp., Van Nuys, N. Y.

Richard T. Girth, vice president of planning, Bendix Aviation Corp., Van Nuys, N. Y.

Dr. Bernard Jacobs, vice president of research, General Electric Co., Syracuse, N. Y.

James E. Nease, vice president of electronics, General Electric Co., Syracuse, N. Y.

William H. Girth, vice president of manufacturing, Bendix Aviation Corp., Van Nuys, N. Y.

John R. Montgomery, general manager, Aircraft Corp., Technical Division, General Electric Co., Syracuse, N. Y.

Robert E. Ruchel, vice president of research, Bendix Aviation Corp., Van Nuys, N. Y.

Donald B. Fink, assistant to vice president of research, Bendix Aviation Corp., Van Nuys, N. Y.

Capt. James J. Davis, Jr., Operations Officer and Capt. Robert D. Cox, Jr., Technical Director, Naval Aviation Supply Office, USN, Philadelphia, Pa.

Honors and Elections

Leslie W. Bean, president of Libertec, Inc., has received the Navy's Distinguished Public Service Medal for his outstanding contributions in the field of Naval aviation and his control techniques, including his own personnel and digital computer for bombing and navigation.

Thomas W. Wicks, of Thomas Wicks and Associates, has been appointed executive director of The Aircraft Service Association, Los Angeles, Calif.

Changes

William B. Schmitt, manager for the Western Division, A. E. Jones Industries, West Orange, N. J.

Richard E. Goss, Jr., director of special projects, The Hartford Corp., 211 Second St., Hartford, Conn.

Clarence A. Whitford, engineering staff specialist—systems, Manufacturing Division, General Dynamics Corp., San Diego, Calif.

INDUSTRY OBSERVER

► Nike guided missile system includes an unusual missile with a range between that of the Hercules and Zeus, intended for use against slower vehicles than an SCRAM, the weapon will not be developed until the Army's role in air defense is clarified by the Defense Department.

► Army's Hawk will be a much simpler weapon to operate than any of the Nike series. Most of the ground direction work will be eliminated through use of the Hawk's internal guidance system. Low operating altitude of the Hawk permits use of command guidance of the Nike type.

► Extremely sensitive magnetometers for submarine detection, which is reportedly capable of detecting change of only one part per million in strength of earth's magnetic field, is now possible, apparently for a new type, being developed by General Electric Research Laboratory. New device, which operates at audio frequencies at room temperatures, makes use of processes of hydrogen nuclei in liquid instead of electron processes as in previous solid state Meers (AW Aug. 28, p. 76).

► Martin Co., which now has contracts for 24 PGM Sea Sparrow jet interceptors, is installing landing capable of a production run of 120 of the aircraft despite the setback in the program by Navy (AW Aug. 26, p. 33). These Sea Sparrow prototypes is scheduled to begin flight tests late this fall.

► Douglas Aircraft Co. is asking for bid for Oct. 11 as the design and construction of the prototype of the first tube-modeling, rapid design, is a building for Nike. One and a half years are to be allowed for the design and development. Unit would take information from the master computer and turn it into a form suitable for display on flat tube and other portions of the display.

► Air Defense Command has issued a requirement for Navy-type intercepting boats for three of its Centers using fighters—the McDonnell F-4H, Convair F-102 and Lockheed F-104. ADC also will install several batteries at most of all its bases. Reason is that the command has lost over 542 million worth of fighters during the last 12 months because of overloads.

► General Pershing Laboratory is negotiating with Deere National Section Inc. and Bendix Pacific, Deere's U.S. and Canadian licensee, over the possible marriage of General Pershing's Radar Display computer with Deere's hyperbolic navigation system and/or Deere's flight log display computer.

► Experimental verification of Houston's special theory to vehicles will be attempted by RIAS Inc., subsidiary of The Martin Co., sometime this fall. Theory says that velocity of a moving object approaches the speed of light, mass approaches infinity and time approaches zero. Theory will be tested by accelerating sound waves from zero to very high speeds and then attempting to measure frequency. Display will be of the sound's frequency light frequency. Similar experiment was performed in 1958, but RIAS scientists hope to improve measurement accuracy by one or two orders of magnitude.

► Army believes STOL aircraft may need new type instruments or automatic controls to use night vision. Tests at University of Wichita indicate average 80% reaction time and judgment do not permit full utilization of the aircraft's short field potential, particularly on landings.

► Army is investigating large diameter, low pressure tires for use on improved landing fields. Special landing gear would include valve mechanism connected with load sensing device. It would automatically reduce the tire pressure on impact with the ground.

► Republic Aviation Corp. will make a decision within the next few days as to whether it will go ahead with plans to produce the Sub-Acoustic light helicopter under license. Atlantic recently completed Phase 2 evaluation tests at Edwards AFB, Calif., and USAF officials are reportedly enthusiastic over its performance.



Dr. Peter J. W. Debye, professor of chemistry at Cornell University, and Dr. David P. Jones, President, Arco Research and Advanced Development Division, discuss the Arco research program prior to Dr. Debye's recent colloquium at the Division of Science, Massachusetts, headquarters.



Planned above is our new Research Center now under construction in Washington, Massachusetts. Intended for expansion in early 1957, this comprehensive laboratory will house the scientific and technical staff of the Arco Research and Advanced Development Division.

Arco's new research division now offers unusual and exciting career opportunities for exceptionally qualified and forward-looking scientists and engineers in such fields as:

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Write to Dr. E. W. Ambrose, Research and Technical Director, Arco Research and Advanced Development Division, 80 South Union Street, Lawrence, Massachusetts.

TO NOURISH AN IDEA

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In the dynamic government man has created, his imagination cannot stand still. He is committed to move forward to new scientific breakthroughs that lay the foundation for a strong economy based on advanced technical achievement.

Creative scientists and engineers, working together in an intellectual environment where ideas can be freely expressed and freely explored, will shape that new economy. Arco is uniting the environment in which accelerated thinking men can search out new problems and work toward their solution. A new research center will provide a physical environment, facilities and contact with stimulating minds to nurture the best ideas that such men can contribute.

Some of America's foremost scientists and engineers are at work here. Consultants like Dr. Peter J. W. Debye, contribute through colloquia and the stimulation of the inter-disciplinary camera imperative to high-level scientific performance.

Arco's scientific approach to urgent national defense problems has already brought advances in high-altitude, high-speed flight, missile re-entry, aerodynamics, heat transfer, materials and other areas. Practical problems have been solved, scientific horizons have been widened. But the greatest challenge at Arco has only work yet to be done.

ARCO

RESEARCH & ADVANCED DEVELOPMENT

Washington Roundup

Louis Johnson: About-Face

Starport about-face in recent military history was performed last week by Louis Johnson, who once served as Secretary of Defense for President Truman. Best reason behind for his strenuous economic efforts that were a factor in America's lack of preparation for the Korean war, Johnson now freely full support for an aggressive national defense "not what it was." He told the Associated Press last week that "We must emphasize our own weapons that no price is too high to pay for the precious gift of national security."

Painful Reminder

Attempts to keep the lid on budget spending has helped even before and attempts have been made to try and pay it off. Recent budget battle was "totally only a paper skirmish in a continuing war on government control spending," U. S. Chamber of Commerce President Philip M. Talbott told the Washington chapter of National Association of Accountants.

Accountants "are translating the terminology of government fiscal affairs for citizens and wherever you live, wherever you go, wherever you will see it and it represents to the cause of economy," Talbott said. "Translating lobbying for supplemental and deficiency appropriations is a 'threat to the cause of economy' that could 'nullify all the good work that has been done,'" Talbott said.

Last May 2, during the "major skirmish" over government spending, Defense Secretary Charles E. Wilson said: "No income in the U. S. Chamber of Commerce, they represent some of the ablest people in this country and they have never been more persistent and they fight to spend so much about the budget gets me a pain."

Congressional Eye

Congressional interest in an agreement between the U. S. and other countries has developed rapidly, as the result of latter agreement U. S. queries expressed to the bilateral agreements reached with the Dutch and Australia earlier this summer (AW June 26, p. 54). Last week, two congressional decisions to see for the first time the progress involved in beginning for air routes and traffic rights. Rep. Owen Brewster (D-ME), chairman of the House Interstate and Foreign Commerce Committee, and Charles A. Wackerlin (D-N. J.) posed U. S. negotiators at a dinner at the bilateral talks with Brazil which began on Thursday.

Missiles Save

Last week's fix in speech by Pennington made clear whether the nation changed the odds. "We have not had a missile threat thousands of miles... to me." "We have not a lot better missile thousands of miles."

Holaday told a symposium on five outside of chambers how that "We must well be faced in the foreseeable future with some adjustment... that how many are defense systems," he said, under the flight caption. "We are actually suffering from two such ideas in relation to design and development," Holaday said. "That is good in the sense of being able to have a better selection of competing missiles but it also makes it difficult to make any selection."

USAF Safety

USAF's flying safety record is improving despite increasing challenges to jets and the increasing complexity of higher and heavier. In the first six months of 1957, the service lost an all-time low of 34 major accidents for such 130,000 flying hours.

The all-time high was in 1922, with 395 per 100,000 flying hours. USAF now has 1,150 annual flying at any given moment.

Hughes' Stock Appeal

Attention for Howard Hughes here to work out an agreement with the Civil Aeronautics Board that work that will permit Hughes to retain his holdings in Atlas Corp., which holds 51% interest in Northeast Airlines. Hughes controls Trans World Airlines through Hughes Tool Co.

As negotiations by the CAB was initiated to determine if Hughes' interest in Atlas would also give him control of Northeast as violation of the Civil Aeronautics Act. At a hearing last week, CAB chairman Paul N. Pottius proposed that proceedings for two weeks to give interested parties an opportunity to voice and an agreement in which Hughes might retain his stock but have no participation in its management of Atlas.

Farewell VIP

There'll be no more VIPs. Very Important Persons, as far as the Air Force is concerned. The phrase and the pink accessories and time-consuming courtesies associated with it have become victims of USAF's economy drive. By regulation, the term is dead. Its successor is DIV, or Designated Visitor, who is supposed to describe any official making of VIP treatment.

Naval Denial

Naval denial reports that its officials under paid effort has been curtailed because of budget cuts. Two squadrons of pocket planes have been disbanded, leaving two in the First Coast and two on the West Coast. Naval maintains, however, that the tempo of its patrol will not be slackened and that present equipment will be fully adequate.

Airline Stock Slump

Airline common stock hitings are now hovering close to their lowest level of the year. Declines have been sharp in the majority of cases with TWA, Capital and United experiencing the most severe drops. On Wednesday, American stock gave an indication of stability, showing an approximate three point decline from a 1957 high of 27 1/2 in 23 1/2 last week. A large part of the decline can be attributed to the sluggish trend of the market in general during the past few months, but some observers feel that the industry's campaign is the recent suspended passenger fare investigation in which the low rate of increase would be unimpaired caused a disappointing reaction among investors. Airline earnings have been off most of the year and an almost every one, advancing programs are under way in preparation for heavy re-equipment plans during the next five years.

Washington staff

Air Force to Continue R&D Cancellations

Fundamental research programs to get some relief; guidelines for all contractors expected soon.

Washington—USAF, aware of the confusion and confusion created by stopgap executive measures in its research and development program, is taking quick contracting steps. It hopes to have preliminary guidelines for contractors by the middle of next week, but officials point out that spending flexibility and therefore confusion will continue throughout the fiscal year.

Outlook is for further research and development cuts before Jan. 1. USAF, like the Defense Department (see page 25), is finding that the spending rate is still above administration-imposed ceilings in spite of stringent economy efforts.

Fast and most volatile reaction to research and development economies came in the area of fundamental research (AW Sept. 16, p. 27).

The entry quickly pointed out contractors at higher Air Force salaries.

Unsettled and other non-profit or not-for-profit contractors charged that removal of contracts has been at a steady state since Jan. 1 and that contract cancellations have been arbitrary. Without proper consideration of importance of the work or contractor and long-range effects on the contractor.

USAF "Panicoid"

One assembly spokesman told Aviation Week that USAF "has been panicked by a bunch of headlines."

USAF is often admitted that this is what happened. A quick look at the budget by financial experts indicated the most immediate savings were to be made in basic research contracts, where no hardware was specified, whose price and other needed elements were uncertain. Such would be low, and where no testing of end items would be necessary after a contract was awarded, as it would with the Lockheed Martin, for example.

A little later, by technical experts put in quickly reduced the lack of wisdom in cutting fundamental research first, not USAF official said.

It is a good general axiom that in the times of war, one should broaden out beyond and look further into the horizon," he said. "If you can't do all the work you want to, you should at least get to the very beginning."

USAF is now looking at a second look at spending ceilings for the Air Force Office of Scientific Research, USAF's Cambridge Research Center,

Wright Air Development Center and other Air Research and Development Command agencies that deal largely with universities and other non-profit institutions.

It fully recognizes its moral obligation to provide a degree of stability in contracting with non-profit institutions, which cannot absorb financial blows as easily as industrial contractors, a top official told Aviation Week.

But he also said fundamental research is for long-term training along with all other Air Force efforts to reduce spending.

Why Confusion?

Basic some of the confusion at all echelons in the USAF research and development program is that no one knows precisely what the spending rate is.

In past years, operational contracts were imposed on the basis of shipboard rates. This rate was known with a high degree of accuracy, at all times, and actual rate of spending got less accurate.

Now the spending rate has been made permanent and agencies contracts must be imposed on that basis. But the contractors have no way to know whether they are being paid the full rate of fiscal 1977, but shipped by with high spending—while officials were trying to determine how high spending was.

USAF has consistently made in fiscal 1977 not falling due and want to be paid. Costs are being accrued under the contract still in effect. This means virtually no new work has been contracted for, research at contract billing has been postponed and spending still is higher than it should be.

"Contract by Contract"

"We have got to go personally contract by contract and estimate what it actually is going to cost to spend before we can know what we do about present work, or new contracts," so Air Force official said.

But we are trying to make sure that the question of fundamental research contracts that have already expired. We are getting into a position to make others at least in the best they expect.

Some officials, Air Force hopes to get the universities some planning in January—some idea of what will happen to contracts well ahead of the time

that they expire. Air Force wants, however.

But that is not to say that there won't be more cuts in fundamental research contracts, or that we can do without continued facilities. It is essential in research work that you have a reliable facility.

The problem is one reason that fundamental research is an early target. In one sense you are least selective at the fundamental research end, where you are in effect trying everything, and you deliver just the production end, where you have chosen only what you want to go on with."

Outlook for industrial contractors is necessarily the same as for non-profit contractors—continuing new and old contracts to some, but with more sophisticated analysis in new contracts; some taken from now on.

Cuts implicit in USAF's decision making will be Jan. 1, USAF's \$17.7 billion spending ceiling for all activities is broken into \$5.95 billion for each half of the fiscal year. How actual spending stands relative to this goal in Jan. 1 will determine much of what will be new, how this rate will be set.

Although the USAF research and development appropriation for the fiscal year is \$681 million, spending at that rate would mean that the fiscal year would end at \$681.

Then, USAF must somehow temporarily bring the spending curve down below the \$681 million line in order to eventually stabilize it at \$681.

ARDC Reschedule

Rescheduling of Air Research and Development Command facilities at Arnold Engineering Development Center, for example, is being moved to fiscal 1978 and will not be for some time (AW Sept. 16, p. 26).

But spending ceiling for Arnold Engineering Development Center, for example, is approximately 25% below as appropriations for fiscal 1978. This has resulted in layoffs, and some cuts in today's work.

Air Force Office of Scientific Research, which about 600 contracts, has recently falling due at the rate of about 50 a month. This means that a dollar is actually stretching well into September has thrown the program into considerable confusion. Other centers have been taking similar action, mainly WADD and AFPCRC Personnel and Training Research Center at Lockheed AF, Tex., has been out of the budget for a while.

But issues do not end contract work and therefore are affected in different ways—personal layoffs, limited construction of new facilities, some decrease in



Large Dive Brake Slows F8U-1P Crusader

Large dive brake slowed Chase Wright F8U-1P Crusader's belly effectively drew up speed to 400 mph on the way up which the photo was taken. This is a first picture showing Crusader's dive brake open. F8U-1P is the one which Maj. Glenn broke one-eighth speed record (AW July 22, p. 36).

not lead, etc. Those include AEDC at Edwards, Tenn., Flight Test Center at Edwards, AF, Calif., Missile Development Center at Holloman AF, N. M., and Missile Test Center at Patrick AF, Fla.

University Changes

Universities and other non-profit research groups doing in "clean" contracts rather than work that produces hardware change that USAF economic actions to be lost.

• Severely restricts residence in USAF is a supporter of research. USAF is unable to accept of this result and is making every attempt to correct it.

"The last thing we want to do is to do what the quite reasonable relationship we have had with these groups," one Air Force official said. "We recognize what the immediate and the long-range effects would be. We think it is pretty a question of communications and that is being worked on. But we also are aware that while these groups have been used as a spending ceiling, you get some shored-up but not."

• Close at the most possible time—the beginning of an economic year. The professors and graduate students are assigned to and supported partly by specific research contracts.

• Ignored economic tests of life process for fundamental research work. Artificial restraint of spending, both by new periods is negotiable with research. • Threatened to waste some money that they save. In some recent cancellations no promotion was made for research and development work done

that for. Therefore, USAF gets nothing for the money spent and cannot continue the work later at the economic picture brightens.

Conclusions, orders from some centers to cut off by 50% of all contracts, and failure to act on proposed new contracts have created problems.

But failure to renew contracts that otherwise would have been renewed shows automatically, has been biggest cause of complaint—along with validity of most USAF project priorities to give any indication what to expect on contracts in the near future.

University Reaction

Some examples of university reactions:

• University of Michigan's Engineering Research Institute is at work with the \$100-million Air Force research contract. The fact it held only one center had all been canceled, although three were in an area which has very high research priority. Others with high priority, even though they had lower priorities, had not been cut. Although that situation is a research problem continued on AFOSR, no contracts with that office had been cut either. The fact that the Institute was told to specify a specific rate of expenditure which it expected. On other, it was told to make a 50% reduction in dollars authorized but unaccompanied in the end of July.

"The situation is somewhat more critical than these facts indicate," a spokesman for the Institute said. "The Institute is not separate. It is a part of the university. It undertakes research partly for the benefit of the industrial sponsors of the university, for the benefit of teachers and graduate students. Some contracts are not directly connected with the academic work but are strictly public service."

"Being a non-profit organization, we can't argue funds to hold personnel and continue the work. We can't wait until the government's pleasure is to return. When contracts are canceled, we have to either find work, to get away on other projects or let them go."

"Before we had X dollars and no work to which to spend them. Now we are being told to determine how much we can spend for August, which is just. We can't live within that situation."

"We are evaluating our position as an Air Force contractor and an end user, research, here, so far, affected (the acceptability of Air Force contracts)."

• Massachusetts Institute of Technology. One of USAF's biggest research contractors among the universities, MIT said it has many people assigned to the task of trying to find out what the research and development work will mean. "If there were a state of confusion the Air Force is now in," a spokesman said. "In trying to find out what is going on, we are looking through as almost completely opaque window. MIT points out that being of such a

Company #100, Boeing B-52, North American B-100
 •Consultants by Navy Douglas A-103
 •Scientists by Navy Douglas A-103, Douglas F-10, Douglas A-103, McDonnell F-101

While the aerospace was cutback in the last few years, the defense and development side (see page 25), there was a report from Houston, Ala. that the Chrysler Corp., builder of the Army Ballistic Missile Agency, had a new plant near to Rockwell Aeronautics production of the Jupiter intermediate missile.

Jupiter vs. Thor

While actual fate of the Jupiter and USAF-111, the present status was decided at the Pentagon, it was reported that Chrysler has stayed in business in general at Houston. While the Army Ballistic Missile Agency does not need a new plant, it is not clear, however, a vice president of the company, did not see the report.

Monroe said "There is nothing I

can tell you at this time. There is too much going on now, so anything to say anything."

The Houston report and Chrysler planned to spend \$500 million on the plant, a figure that would mean Chrysler would be a major force in the defense industry in the Detroit area, some of them built with the aid of government money.

USAF Policy

Pending a Defense Department decision on the IRBM it was widely believed that USAF would stick to its policy of housing as new manufacturing plants while the need is proven.

On the other hand, there was evidence that Chrysler was encouraged by Army interests. The company has been conducting an elaborate advertisement campaign in the Detroit area, the headline and Jupiter projects and paying tribute to Army's missile program.

'Austerity' Is Industry Watchword

Atlantic City, N. J.—Despite the uncertainty of a sudden, sharp drop in business, optimism of the American Industries Association played last week to sustain their defense effort. But, AIA President Cyril B. Cook warned that recrudescence of the complex industry will be a single matter after the Defense Dept. makes a decision, present concern, direct action by the design and production of new weapons.

Cook, former USAF national officer, said "nothing catastrophic has happened" to the industry, although it must make some important adjustments. At the same time, he told the American Legion American Committee, AIA agreed the military services had no objection to support the industry.

"Our companies have never felt that the industry goes out as customers," Cook declared. "With a change in emphasis and a reduction in the production of air armaments, competition will be severe. The industry has always been competitive and it will continue to be."

Industry Cuts

Cook said the industry as a whole will effect a 5% cut in its work force by the end of next month. A similar 5% cut in progress programs will have completed by mid-June, he said. However, said Cook, the industry has been studied to a minimum and facilities will be cut back.

"Anxiety," he said, "will be the watchword throughout the entire au-

lumn, engine and components industry."

The AIA chief predicted that subcontracting will be reduced. The aid of the industry will take place as the work load decreases in airplane and engine factories because "it is not likely that a manufacturer will have a full order book for a long time and not high occupied work continues to turn out of the can do the job better and at lower cost."

Cook said guided missiles are going to be of increasing importance to the defense industry and that the entire manufacturing is best equipped to design and build missiles. He depicted the development of missiles in government, military and university, pointing out that there is a loss of time and efficiency in moving these projects from outside agencies to industry for production.

Industry Deliveries

Cook cited the decline in aircraft industry deliveries over the past few years.

In airplane goods, the figure fell from 143 million in 1971 to 130 million in 1974, 131 million in 1975 and 95.5 million in 1976.

He said AIA expected that the next turning point, with the achievement of a large delivery goal, would be reached in 1981.

Changes in this outlook were feared, he said, by the Defense Department's Fiscal 1978 ceiling of \$18 billion in expenditures.

On top of increasing complexity and

Minor Interest

Growing interest in Alaska will be spurred here by recent bills that can be passed by the House and Senate. The new, old state statute, which can provide extremely low income tax rates for Alaska. The Alaska Development Corporation, established by the Alaska Development Corporation, is now in the process of developing a new, old state statute, which can provide extremely low income tax rates for Alaska. The Alaska Development Corporation, established by the Alaska Development Corporation, is now in the process of developing a new, old state statute, which can provide extremely low income tax rates for Alaska.

ing production costs, an important factor in defense, this activity was in low level. Equipment was being developed ahead of schedule in industry and government efforts in the field have been slow.

Cook predicted that in the future there will be faster parallel development because economies will dictate the choice of a weapon to be put in production.

He said that trend was repeatable and acceleration of the North American missile made and predicted that the practice will be followed on future ballistic missile projects.

New High-Lift Design Studied by Fairchild

Phoenician, Md.—Fairchild Aircraft Division reported last week that it has completed initial research on a high lift "jet wing" aircraft which the Office of Naval Research terms "a significant step toward development of an entirely new type of aircraft."

A Fairchild spokesman said the "jet wing," which discards the entire structure of the powerplants over the wing surface, through boundary layer type lift, is an extension of the boundary layer lift boundary layer control technique. The full jet wing, he said, "another complete specimen and, 'full drop jet'."

The research program, originally sponsored by ONR, was completed under contract from the Navy's Bureau of Aeronautics and Army's Transportation, Research and Engineering Command.

A new program to develop new concepts for a controlled "jet wing" prototype is scheduled for completion in June of next year.

The possible application, Fairchild says, could be of use to smaller aircraft to launch and recover higher performance aircraft incorporating the "jet wing" design. The company also says the design can be applied to commercial transport.

Short-Haul, Cargo Lines Must Re-Equip

Delft, The Netherlands—A decade of economic and technical consolidation in civil aviation that will see cargo carriers and short-haul operations re-equiping the largest cargo airlines. The aircraft industry is expected to see a significant industry re-equiping with new, more efficient cargo aircraft. The aircraft industry is expected to see a significant industry re-equiping with new, more efficient cargo aircraft.

Re-equiping, however, the second in a series of aircraft programs. The first, the DC-8-60, was the DC-8-60's replacement of jet transporters will not become obsolete soon enough to open a supply of old aircraft for short-haul use. The aircraft industry is expected to see a significant industry re-equiping with new, more efficient cargo aircraft.

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the anticipated unit-mile cost of the DC-8.

The DC-7C, he said, produces 23 units per dollar while the DC-8 produces 31 units per dollar.

Of the 325 airlines of all sizes operating in the world today, less than 40 have ever had the experience of introducing a new model airplane. Selecting the right airplane for the route will not only be the experience of others but also the airplane is difficult and no matter how good the design, some experts, and trouble must be expected in taking over a new airplane. However, their practical experience should be more to consider as a new technical and financial decision before being. One major headache in the training of maintenance and flight crew.

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might better be directed at the more than 100 shippers.

In many places in the world, air freight is growing more rapidly than in other modes. Between 1945 and 1975, freight income in air freight was 346% as compared with 270% in the U.S. Canada gained 144% and India 558%. Economic growth of underdeveloped areas should produce streams of cargo traffic susceptible to the west-bound. Raymond said.

It hardly seems at this present level, a forecast based on gross national product indicates a further increase of 145% by 1980.

Raymond said the DC-7D transport cargo plane now being designed at Santa Monica would cut total direct operating costs in two-thirds. With a direct route, the freight rate would be the shippers a cut of 10 cents per unit-mile. At that point, Raymond said, total world traffic volume for 1967 at nonstop routes 11 billion ton miles.

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NMIC Promotes First Meeting; AIA Doubts Interest of Primes

Washington—National Missile Institute Conference is scheduled to hold an open-house meeting later this week, doubtful if its promoters as a series of open-house meetings to the industry of the industry.

Aircraft Industries Association reported last week that "probably neither prime contractor missile companies nor top management of air companies have participated in the proposal for a NMIC."

While evidence of industry support for the proposed group is still elusive (AW Sept. 16 p. 10) there are indications of a potential meeting between NMIC and Missile and Rocketry magazine.

Invitations to the first formal meeting were sent by Edward W. S. Hall, assistant editor of the magazine, who said NMIC's "promoters" had asked him to serve as a central source of information until a Washington office is created. Along with Hall's notes, went a letter from Eric Ruckelshaus, editor of Missile and Rocketry, asking the addressee to take part in a three-day national missile conference here beginning next May. [E]

Belmont says his magazine is "sympathetic" to the meeting with the industry. The Hall letter makes it clear that NMIC will be the corporate with Missile and Rocketry and that the plan calls for an annual publication.

AIA Report

Meanwhile, the Guided Missile Committee of AIA has been asked by its Washington section to "have an open house" of the origin of NMIC.

An AIA memorandum lists nine firms whose names are being used by NMIC promoters as "interested" or "instrumental" in the proposed group. Management of at least two of the companies say they never heard of NMIC.

The identity of the industry agencies of NMIC will not clear, if they exist.

In a memorandum to the Guided Missile Committee, AIA reported:

"AIA staff personnel have made numerous inquiries concerning the proposed organization from sources of possible information, such as the Defense Department, several GCM members, several AIA companies as well as the magazine Missile and Rocketry. Favorable results of our inquiries do not present a very clear picture of the origin of the proposed organization, the individuals who have interested

themselves in it to date, nor of future action."

Some of the companies whose names have been mentioned in earlier issues interested in the NMIC or associated in its organization are:

- "Theory Engineering Co., Franklin Park, Ill.
- "General Chemical Division, Allied Chemical & Dye Corp., New York City.
- "Aero Research Laboratories, Cambridge, Mass.
- "Aircraft Corp., New York City.
- "Rocket Motor Inc., Trenton, N.J.
- "Cooper Development Corp., Los Angeles, Calif.
- "General Astronautics Corp., Hawthorne, Calif.
- "Hercules Industries Inc., Wilmington, Del.
- "Aerovox Rocket Co., Wyandotte, Mich.

"Informal checks made with some members of a couple of these companies have indicated no knowledge of the NMIC."

Analysis

AIA's analysis of the information available:

- "The underlying purpose of the proposed NMIC appears to have a strong public relations flavor.
- "The proposal for a NMIC may have been made in its campaign for membership and its coverage in the press for the proposed for a 'Guided Missile Institute' of several years ago."

Airlines Say Baltimore Has Adequate Service

Washington—Domestic airlines last week defended their stand against diverting flights from Washington's National Airport to Baltimore's Friendship Airport in unison, and in some instances to the public.

Airline representatives appeared before the Civil Aeronautics Board in testimony on the adequacy of airline service to the Baltimore and Washington areas. Both American and United Air Lines told the CAB that their present service scheduled into Baltimore is sufficient to meet the demand.

Baltimore representatives, on the other hand contend that Friendship does not have enough scheduled service to meet the needs of Baltimore and that a large percentage of its travelers are forced to go to Washington to board flights.



SEMICONDUCTOR: portable amplifier (R) performs same function as radio heart (L)

New Semiconductor Aids Miniaturization

Calder City, Calif.—Semiconductor devices which sometimes a volume function do not perform the different functions of a variable capacitor, opening up in reduction of size, weight in instrumentation and communications equipment, has been developed by Pacific Semiconductor, Inc.

Capacitors of the device is used in elongating the small die, low voltage applied across its terminals. Pacific Semiconductor acknowledges that the basic semiconductor employed has been known for some time (AW April 3, p. 67), but says it is the first to offer a viable device on a regular production basis.

Variable, as device is called, can be used for tuning frequency modulation (FM) receivers, modulating FM transmitters in telephony and communications. Device also shows promise as a variable capacitor for use in electronic circuits.

In addition to small size and weight (comparable to transistors) and, once device is perfected, low power consumption, the low temperature coefficient that conventional variable capacitor.

Present production units are available with Q's of 15 to 40 at 50 ohm capacitance ranges up to 100 pF, which tends to limit their use to narrow-band tuning. However, Vario devices now under development are expected to extend these ranges and increase number of possible applications, companies say.

Vario will operate over temperature range of -60°C to 150°C. There is expected to be comparable to conventional silicon diodes.

6th Anglo-American Aeronautical Conference:

Titanium Applications, Testing Appraised

Polyspace-Heald contractors on the application of titanium and the testing of complete structure to do variations highlighted the sixth Anglo-American Aeronautical Conference here. First speaker, a representative of our experience with titanium in the industry by Len Schapiro and Emerson Lofthouse of the Douglas Aircraft Co., looked off the most productive of the discussion. Another speaker, an industrial engineer, outlined the philosophy of testing a complete structure to destruction exemplified by the water tank technique used for the Concorde and Britannia bombers.

The A. E. Russell of Bristol and Dr. P. B. Walker of RAE Farnborough took opposite sides in an exchange of comments that provided the best technical workshop of the first day meeting. Several regulations were raised to discussion periods, and an outstandingly poor public address system drove delegates to gather in small informal groups to discuss out-moded problems.

Unavoidable Presentation

There were better technical comments from some delegates about quality of papers. As one example, there was a criticism of the paper by Dr. J. V. Dwyer on "under power" requirements for aircraft was completely unrelated to such an audience. Downward, who is one of Britain's top experts on titanium, was out of his depth discussing aircraft design problems.

Inflexibility of time limits brought other criticisms. Discussion of Schapiro's titanium paper was put moving much—it was the most exciting and productive of the formal sessions, when Sir Wilkes Corson, chairman of the session, interrupted to close meeting because of time.

Objections of conference organizers that Corson had done this at an Anglo-American Conference when he stopped the completion of a presentation as far as possible without power points.

Titanium Testing

Schapiro and Lofthouse presented "state of the art" research with the metal first in the X's research aircraft program and later in the conventional DC-7 series of transports. In their papers of the X-7 where temperatures reached up to 800 deg C—preheating, extreme shock loading and compression—549 titanium components were used. Schapiro said failure and fracture tests were extremely small, practically all of losses were due to inherent metal characteristics, and every forming method available to the plant was used to do results. Weight of titanium in each aircraft totaled 145 lb, representing a weight saving over standard steel of 70 lb.

Later 450 lb in 333 parts was introduced on each of the early DC-7 aircraft replacing standard steel engine brackets, and with new parts held down the "state of the art" was stepped up to 800 lb on DC-7C and projected use on DC-8 is 600 lb in the engine pods and pylons, 300 lb in fuselage and controls and 14 lb of log rails.

Still Expensive

But in spite of this progress Schapiro concluded that at \$20 per lb titanium was still uneconomical and that Douglas was determined to use the metal in substitution of false price reductions.

British metallurgists commented on processing, metalworking, surface treatments and mechanical analysis done by Douglas with titanium, including Corson's identification of "titanium needles" that other speakers warned the world had never been lifted from slowness.

Saying that "a mountain had indeed been lifted from a mole," Major P. L. Tind of Works Armaments—author of a monumental paper on fatigue in metal—advised whether use of only 150 lb of titanium in an aircraft weighing hundreds of thousands was justification for huge program implemented by Douglas.

Schapiro, stating that he was beginning to waver in his determination, noted that his company had not made a mountain out of it. Douglas' high approach had been a rather and conservative appraisal of the metal.

Quide Present

Speakers questioned why so little use had been made of titanium and both Schapiro replied that was not a hard and brittle metal present and that on a weight/area ratio basis, there had been little advancement to tackle severe machining problems of titanium with multitudinous of high strength steel with good fatigue properties.

British question on use of titanium was divided, but a number of speakers, notably from Short Brothers and Harland, advised that some attention should be paid to its replacement in reference aircraft in future to provide work on high responsive high speed applications.

Short Brothers maintained they had built a complete integrally stiffened wing for a subsonic aircraft weighing 145 lbs less than an equivalent aluminum alloy wing. Substructure machine-rolled metal, copper and lead, had been established in forgings such as control valve levers, wing root attachments and fittings. Problems reported by Short on short fabrication included thin metal sections, "hydrogen embrittlement" and up to 0.3 in. dehydrate loss between.

Compressor Blades

Both-Rogers was the only other company reporting on user experience. It had been some between compressor blades "highly successfully" for some time and the particular advantage was the reduced die weight possible. First short and second, main shafts and main engine were added later, the compressor reported.

Dr. A. E. Russell, chief engineer, Bristol Aircraft Company, discussed the metal's use in the Concorde and ended in agreement with Dr. P. B. Walker of RAE Farnborough who had been associated with the water tank fatigue test program for the Concorde. Both maintained that using a complete aircraft based on titanium highlighted the critical evidence area on which inspection of service aircraft would be concentrated.

Some Wastefulness

Russell said he was strictly against the wastefulness of expending a complete modern aircraft for "between-twinning of inspection" and insisted that disciplined statistical testing of specimen availability was important.

But Russell also warned that fresh metal restrictions in expansion needed to be critically reviewed and that the metal and philosophy he advocated should not lead to complacency in the design group.

An American Airlines spokesman, citing the losses of up to 150 lb of forgings in the first two of its aircraft due to mechanical problems, called for less complacency of brand of complete decompression and more design considerations considered in terms of weight loading damage.

First discussion of meeting was at C. W. Elger's presentation of work done at NACA's Aeronautics Laboratory on increasing static lift with boundary layer control.

Dr. C. W. Lathrop, who heads Hendley Page's considerable research effort in this field had high praise

for Harper's paper, saying there were three special points:

- Concentration on systems and engineering details needed to get a quality air low pump horsepower system in the air.

- Presentation of effectiveness data in a single way so that those outside the main thrust intensity could understand it.
- Diagram of the "real testing" that power structure needed for distributed action backed up by me.

Abstract of my flight experience from Monday Page or Victim indicated the service will be receiving French work in this field. Luchman did point to the boundary layer control system developed by Armstrong. Several Wicks which run a system of motion needles placed two at three

boundaries later thickness apart and acting at certain positions. The system gives, however, the actual quantities reported with only small reduction in lift coefficients.

He also said his company is using an electronic flight control system which controls aircraft using RLC to approach on throttle control of devices and that control their pose flight path characteristics at speeds below minimum drag speed.

Speed Goal

Ruffe-Royce claimed that the flow characteristics of the bypass engine made it ideal for RLC aircraft and said it could supply air for blowing with jet's thrust penalty. Dr. H. H. Koenig at Naval Ordnance Laboratory said they are trying to obtain speeds on

the order of 16,000 fpm with 40 mm propellers fixed in a 1,000 ft position. Lord says. Koenig also discussed the role of hyperboloids in aircraft and missiles, and that use of the propeller was determined by need to use boundary layer clearly. The new 1,000 ft image is now under construction.

Stalling Flutter

Franklin K. Moore of Cornell Aeronautical Laboratory, who generated a treatment of boundary layer considerations, pointed out that there was a possibility of something like stalling flutter in the use of high aspect ratio wings in high lift VTOL or STOL applications. He said that steady movement of a boundary layer separation point would also be an obviously powerful mechanism for generation of noise.

Aircraft Firms Submit Financial Figures

Financial details reported to the House Armed Services Investigating Subcommittee by five major manufacturers in connection with the subcommittee's proposed investigation of 17 aircraft engine firms (AWA-Ex. 1, p. 20) are shown below. Despite much publicity by the subcommittee's chairman, Rep. Edward Hecht (D-La.), as the importance of the project, it was dropped because members did not want to remain in Washington beyond congressional session.

General Electric Co. Aircraft Gas Turbine Division		1952	1954
Total Sales		\$2.5 million	\$4 million
Sales to U. S. Gov't		\$174 million	\$174 million
Percentage of total sales		100%	100%
Net worth		\$67.5 million	\$71 million
Outstanding debt		\$17 million	\$17 million
(includes, actual per share)*		\$2	\$2
Research and development			
Total value of contracts awarded			\$27,125
Costs and expenditures			\$14,489
Revenue paid to aircraft industries			\$7,641
Research and related expenses		\$1.7 million	\$2.4 million
Government-owned property		\$48.8 million	\$50.3 million

*For General Electric Co. as a whole

Westinghouse Electric Corp. Gas Turbine Division		1952	1954
Total Sales		\$40 million	\$30 million
Sales to U. S. Gov't		\$40 million	\$40 million
Percentage of total sales		100%	100%
Net worth		\$20 million	\$20 million
Outstanding debt		\$20 million	\$20 million
Research and development			
Total value of contracts awarded			\$7.5 million
Costs and expenditures			\$24,025
Revenue paid to aircraft industries			\$17,641
Research and development		\$105,125	\$14,675
Government-owned property			\$14.6 million
Profit		6.6%	10%

Avco Manufacturing Corp. Lycoming Division		1952	1954
Total Sales		\$63 million	\$63 million
Sales to U. S. Gov't		\$48 million	\$48 million
Percentage of total sales		76%	76%
Net worth		\$53 million	\$71 million
Outstanding debt		\$5 million	\$5 million
(includes, actual per common share)		\$1.00	\$1.00
Research and development			
Total value of contracts awarded			\$15,000
Costs and expenditures			\$20,814
Revenue paid to aircraft industries			\$17,641
Research and development		\$17 million	\$17 million
Government-owned property		\$75	\$75
Profit		10%	7.2%

United Aircraft Corp. Pratt & Whitney Aircraft Corp.		1952	1954
Total Sales		\$407 million	\$522 million
Sales to U. S. Gov't		\$278 million	\$377 million
Percentage of total sales		68%	72%
Net worth		\$142 million	\$178 million
Outstanding debt		\$22 million	\$21 million
Research and development			\$2
Total value of contracts awarded			\$10,000
Costs and expenditures			\$41,078
Revenue paid to aircraft industries			\$14,675
Research and development		\$11.5 million	\$10.8 million
Government-owned property		\$12.5 million	\$12.5 million
Profit		7.2%	7.6%

EEMCO ACTUATORS

Meeting the stringent requirements
of today's Missiles and Jet Aircraft

are now in use in the majority of our
latest serial weapons



Type 9.525 Rotary Actuator for Missile
In Weight: 4.5 lbs. Max. Operating Load
25,000 lbs. Max. Torque: 25,000 in. lbs.
Stroke: 1.17 in. Rate of Travel: 27
in. per second. Max. Speed: 4,000 in. per
second. Max. Torque: 25,000 in. lbs.
Max. Torque: 25,000 in. lbs. Max. Torque:
25,000 in. lbs. Max. Torque: 25,000 in. lbs.



Type 3.412 Power Package, Size 7 1/2
x 4 1/2 x 2 1/2 in. Max. Operating Load
12,000 lbs. Max. Torque: 12,000 in. lbs.
Stroke: 1.17 in. Rate of Travel: 27
in. per second. Max. Speed: 4,000 in. per
second. Max. Torque: 12,000 in. lbs.
Max. Torque: 12,000 in. lbs. Max. Torque:
12,000 in. lbs. Max. Torque: 12,000 in. lbs.



Type 3.412 Torque Converter, Size 7 1/2
x 4 1/2 x 2 1/2 in. Max. Operating Load
12,000 lbs. Max. Torque: 12,000 in. lbs.
Stroke: 1.17 in. Rate of Travel: 27
in. per second. Max. Speed: 4,000 in. per
second. Max. Torque: 12,000 in. lbs.
Max. Torque: 12,000 in. lbs. Max. Torque:
12,000 in. lbs. Max. Torque: 12,000 in. lbs.



Type 6.018 Loading Gun, Size 7 1/2
x 4 1/2 x 2 1/2 in. Max. Operating Load
12,000 lbs. Max. Torque: 12,000 in. lbs.
Stroke: 1.17 in. Rate of Travel: 27
in. per second. Max. Speed: 4,000 in. per
second. Max. Torque: 12,000 in. lbs.
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12,000 in. lbs. Max. Torque: 12,000 in. lbs.



Type 3.412 Torque Converter, Size 7 1/2
x 4 1/2 x 2 1/2 in. Max. Operating Load
12,000 lbs. Max. Torque: 12,000 in. lbs.
Stroke: 1.17 in. Rate of Travel: 27
in. per second. Max. Speed: 4,000 in. per
second. Max. Torque: 12,000 in. lbs.
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Nike Warhead Price

Aluminum warhead for the Nike Hercules missile costs in the neighborhood of \$1,000,000. Nike Ajax warheads cost about \$15,000 for current production models. Hercules should not be much more expensive in quantity. First difficult choice was choice of varying yield as available to Hercules firing batteries.

Skin-Forming Machine Developed for Titan

El Segundo, Calif.—Hillford Corp. last week demonstrated its barrel stretch machine for forming integrally stiffened extruded aluminum for Martin's Titan intercontinental ballistic missile. Machine is now undergoing proof tests at Hillford and will be shipped to Martin's Denver plant later.

In ICBM's, two approaches have been used structurally. Convexity's Atlas uses thin skin with pressurization replacing expedited fuel and avoiding to retain structure's shape, rigidity and integrity while Titan uses thicker pipe aluminum alloy skin integrally stiffened, thus no integral tank configuration.

The Hillford machine takes punch extruded by Alcoa and Hiner Alcoa alloys. The latter formed "sheet" punch measuring 74 x 140 in. in record while Alcoa punch is 34 x 250 in. Both punches are 2014 alloy, 57,000 psi ultimate tensile strength. Ultimate properties is accomplished by heat treatment in Hillford processing, surface rolling in close fit, relieving the main punch thickness to 150 plus or minus .005.

High center hard extruded punch plus skin feed subsequently yield five various grades. Voltage thickness check, a radio and profilometer is used to check contour.

Punch is formed to a 60-in. radius, indicating a tensile character of 10 ft. After the punch is started in the machine, radio and profilometer and lower die pushes up to give the proper curvature. The components slots for the stiffening structure and pins them into it, give the punch and a stretch to 4% of original length is required to get the curvature and prevent springback, rather than extend punch length. Stretch also tends to relieve stress imparted in skin forming.

Punches are expected, heat treated and aged to 70 condition with 57,000 psi yield and 64,000 psi ultimate tensile.

The punches are then cleaned and fed to the final thickness, which is .070 plus or minus .010 for regular sections. And on the outside surface of the skin,



British Olympus 101 Undergoes Test

Under development with variable thrust is fired as the British Olympus 101 undergoes for tests of the combined powerplant. Olympus 101, primarily a production engine for the Avon Vulcan bomber, is being used as a test engine and is not scheduled to leave the Avon Vulcan. Afterburner thrust increased can be varied from zero to about 40% under take-off conditions and has been tested through this range on the stand. Afterwards it is expected to be fitted on a later model Olympus (airframe) for a new aircraft project. Speculation is that project is a British stealth aircraft designed for supersonic range above Mach 2.5.

extreme products are anticipated between the refineries, with material thicknesses now being 0.015 plus or minus .007.

Punches are butt welded 12 forming a circumference, and several in the varying lengths making up the longitudinal tensile portion of the missile. Each panel has three stiffeners in T form with flange approximately 1/16 in. thick in one from skin, and web thickness approx. 1/32. Stiffener web is approx. 1/16 in. high from skin portion to bottom flange, while the flange is approximately 1 in. wide.

The stiffener sections on the exterior do not run the full panel length, and are located near one end then the other after final turn. Products are at most 10 in. wide in certain between stiffeners, with taper at each end and rounded ends, similar to a blunt nose shape with some taper ahead of it.

Missile skin undergoes final check, then are shipped to Denver.

News Digest

Avco Aircraft Ltd. will sell out the CP-105 Avon Arrow, 4000 wing, early October Oct. 4 at Millers, near Toronto.

Construction of Republic Aviation Corp. new main facility begins last week at Farmingdale. One terminal will cover the transonic area, a second will go up to Mach 4. Facility, costing \$1,200,000, is of blow down type.

RAAF Orders C-130s

Adelaide, Gasfield Australia. Air Force has placed order in excess of \$15 million with Lockheed Aircraft Corp. for 12 C-130 Hercules transport, including spares, crew training and support equipment.

Delivery of the 42 ton cargo-lifters can start in October 1966. Plans, which are scheduled to flow in order by USAF, Lockheed Air Command, will be delivered directly from the production line at Marietta, Ga.

CAB Fare Decision Draws IATA Fire

Statement reiterating CAB stand against fare hike raises ire of delegates to annual IATA meeting.

By L. L. Doty

Multi-International Air Transport Association of Civil Aeronautics Board's stand against any fare increase was sharply reiterated during the closing session of the 17th annual meeting here by the advisory CAB statement reaffirming its position.

The statement, drafted by the IATA traffic committee which meets tomorrow in Miami, was termed "unfriendly" and drew a suggestion from one delegate that U.S. carriers may be acting in collusion with the Board in blocking a fare increase. It was evident, however, that representatives of the U.S. airlines were opposed to the CAB's reaffirmation of its fare philosophy at this time.

Why Disapproval

The Board, in its statement, made public during the meeting, declared that "... There is no economic justification at this time for adjustments which would result in an increase in the small percentage of passengers paying to the carrier from operations on the North Atlantic." It added that the Board similarly has no need for a change in the base fare levels now in effect on the North, South and Mid-Pacific routes.

The Board emphasized it felt "the currently effective fare levels to be appropriate for the various phases of recovery now being experienced." It added that, in upholding the CAB's 5% fare increase proposed by IATA, it pointed out that "the interests paid by the carriers for supplies, etc., have not been sufficient to compensate expenses in the real interest in providing the service."

It said it strongly supported the three-fare level agreed upon by IATA, members to become effective April 1, 1958 and added:

"That fare will permit, under reasonable conditions of service, the offering of a service sufficiently attractive with respect to both quality of the service and cost to the passenger, to develop the potential market while, at the same time, affording the carrier an adequate revenue return."

Foreshadowing the CAB statement on high income fare delegates during the final hours of the annual meeting

when the airport was crowded, particularly when the committee had agreed to accept the CAB decision at final. Sir Wilfrid Hildred, IATA director general, said the association would not petition the CAB to reconsider its refusal to grant a 5% fare increase but had accepted the disappointed "with dignity."

Fare Increase Disapproved

European and U.S. carriers over the strongest advocates of a fare increase during the meeting and maintained the immediate need for high revenue yields as the only means of offsetting mounting costs being experienced by most carriers.

International traffic carried by European airlines would exceed that of transatlantic traffic carried by the American members. They paid IATA by European and Middle East airlines account for more than half the total fees.

Gen. George Poyet, administrator general missions of Casablanca de Transport Aeronautiques, declared that American Wreck that a fare increase will be an essential factor toward rising sufficient capital to cover costs of the new DC-7s and DC-7Cs. The French carrier has ordered 100 new European carriers ordered Europe's new.

Speaking for British Airways Airways, Lord Douglas of Kirtland, acting IATA president, termed the CAB action as "blatant" and "unfriendly" and underscored the capital requirements of airlines in equipping for the jet age.

The British airlines were less interested in the matter and unwilling to support the CAB for its action. B. R. Hall of Air Lines International told American Wreck that he has no need for an increase, although Seaplane, president of Japan Air Lines, said fares should be up and added that he would be hesitant in going his way part in a three-fare plan on the Pacific.

Tasman Sides With CAB

So Leonard Jett, chairman of Tasman Empire Airways Ltd. (TEAL), said bluntly that he opposes any fare increase because of existing competition in the sale of cargo on the New Zealand and Australia routes. He pointed out that the Australian govern-

ment is required to put a 25% increase in the air transportation because of the difference and that a fare increase would only serve to intensify the disparity.

In this connection, the executive committee of IATA announced during the meeting that worldwide governing currency exchange rates in relation to fares and other basic deficits. The committee said the proposals "appear very much simpler" than present regulations and, if accepted, "will save carriers a number of headaches in the future." The plan would, in some cases, restrict the purchase of fares to specified currencies in particular areas.

Neville Tress Canada Air Lines and Canadian Pacific Airlines was behind the move to bring about a fare increase in 1958. Many executive members of the committee of CAB and he said he could not "higher" fare and establish a fixed-rate fare without changing the general fare structure on domestic and international routes.

Traffic Conference

Officially, the traffic advisory committee did not comment specifically on any proposals, which will be discussed by the traffic committee at Miami this week. It did not, however, that one of the chief items on the traffic conference agenda at the proposed North Atlantic flight or three-fare level and seemed to indicate that "everything possible has been done" to increase the fare. The group should have adequate resources to show before coming to the conference floor.

The conference also is expected to adopt a set of principles which would be adopted by the domestic carriers and to pass on recommendations to increase travel speed and capacity. Although it is not to reduce the number of the international passenger fare structure and steps will be taken to eliminate present deficiencies in the international governing freight and cargo discounts.

The executive committee warned that the recent CAB order penalizing U.S. carrier members of IATA has been heard by IATA members has "serious implications." The CAB decision, which requires more from a complaint filed by a non-IATA carrier, put before IATA member U.S. carriers involved only in a domestic U.S. segment of the international transportation covered by the regulatory question.

In its criticism of the CAB, the executive committee told the association



IATA delegates at 17th annual general meeting, Miami, are welcomed by 1957-58 executive president Thomas Dillards, of Decca Airlines (left). Seated president Lord Douglas of Kirtland, British European Airways, looks on during opening session (right).

that "the situation will require to be watched" and added:

"While the common sense of members has so far limited the possible overhauling of the CAB's action, the adoption of the principle inherent in the CAB order by other governments could lead to the complete undermining of the IATA structure."

The committee explained that under the CAB philosophy, IATA members are to be compelled to treat traffic in domestic sectors as though they arrived at by a combination of domestic and non-IATA international lines that could thereby undercut fares agreed upon in the IATA traffic conference.

The executive committee also called the attention of delegates to the high cost of IATA enforcement proceedings. Advising that enforcement is "so absolutely necessary," the committee said \$211,000 of the 1958 IATA budget of \$1,200,000 is allocated for enforcement activities.

New Treaty?

The legal committee warned delegates that a new international treaty may be required to simplify the charter and maintenance of aircraft in order to obtain maximum utilization out of high-cost equipment.

The committee concluded that the Chicago convention "contains a framework that should permit the handling of issues without error, as well as issues with ease, whether on a term basis, a voyage basis or in interchange."

Although the committee agreed that certain problems lay open in the respect in the right of certain requirements of individual governments, it held that such problems can be handled through the government concerned or by bilateral or regional arrangement.

The committee said, however, that difficulties may arise in the use of the base of aircraft with crew to an entity other than an airline. The committee

suggested that, when such a base involved the carriage of passengers, any questions as to the liability of the airline as a base could be settled by making upon the issuance of tickets to passengers carried under a charter agreement. Such a procedure would automatically put the transportation under the rule of the Warsaw Convention which establishes liability limits.

Cargo Losses

Losses of aircraft with crew for the transportation of cargo pose a different problem, the committee said. In such cases, the shipper would hold the airline liable for the loss or forwarding and not those of the losing airline.

As a result, the owner of the aircraft would not have the protection of the Warsaw Convention liability limits which he holds when carrying cargo under his own airline bills and could, therefore, be open to suit by shippers directly in port and without limitation.

Under the conventions, the committee recommended some supplement to the Warsaw Convention to present any situation that cannot be satisfactorily resolved under the present conventions.

The IATA legal committee also called for the completion of a convention on aerial collisions.

ICAO Proposals

The group supported recommendations of the International Civil Aviation Organization air transport committee proposing that the liability of each aircraft involved in a collision should be covered by the following limitations:

- Twice the limits of the Warsaw Convention established for passengers, cargo, registered baggage and goods and personal contents.
- Market value, placed on aircraft involved in a collision immediately prior to the collision.

The legal committee also reiterated IATA's stand on the legal status of the

aircraft and the aircraft commander that there is no urgent necessity for a convention to define the authority of the pilot-in-command in relation to persons committed or carried in international flight.

Passenger carried by IATA members in scheduled service showed a 115% increase between 1949 and 1956. Revenue per passenger-kilometer jumped 227% during the same period, in its latest statistical report, the association also reports a passenger load factor of 64.4% for 1956 as compared with 64.2% in 1955. Highest load factor was reached in 1951 when 68.4% was recorded.

Passenger Average

Average passenger per aircraft in 1956 amounted to 11.6 and average tonnage per aircraft, 49.5. Average tonnage per aircraft, 49.5.

Number of employees in service with IATA member airlines totaled 304,000 but not during the opening fleet of the airline was 2,790 airplanes.

Czech Airline to Use Tu-104s on Arab Run

Vietnam-Czechoslovakia's transport department announced recently that the Soviet Union has agreed to let Czechoslovakia buy the first three Soviet Tu-104s. The aircraft are to be delivered to Prague this fall.

The CTEK airline will use these such on Prague to Ginevra and Prague to Beirut and Damascus. The new line will start operating in November.

The Tu-104 flights to the Arab countries will be non-stop. A Prague to Moscow route will also be flown, flight time to be 3 hours 75 minutes. Czechs now have routes to 14 countries, will have 19 countries to do air business with at the end of this year.

ACC Details Future Traffic Needs

Washington—An Coordinating Committee has warned that aircraft and distance measuring capabilities of Vortec will be required for air traffic control and positive separation of aircraft by as late as 1965.

In a paper approved by its Air Traffic Control and Navigation Panel, the ACC said the air traffic control system must be based on Vortec facilities and that all aircraft operating under IFR and VFR subject to positive separation must be equipped with both distance measuring and altitude capabilities "as soon as possible."

Aircraft which are not retrofitted for use on either IFR flight or VFR flight under positive control will not be required to meet the Vortec standards, the group said.

A target date of no later than 1965 was called for by the ACC in establishing the distance measuring portion of Vortec on a western basis. However, the group stressed the urgency of the need for implementation of the Vortec system by stating that the target date "should be the earliest practical date which can be met."

The group and several government agencies believe Vortec facilities serving basic route structures should be 75-100 miles. A maximum spacing of 155-211 miles should be re-

spond in selecting Vortec facilities to define and provide service on intermediate altitude route structure. On high altitude route structure, spacing of 311-611 miles should be employed, the ACC stated.

The report, entitled common system operational requirements for Vortec, was approved by the air traffic control and navigation panel acting on behalf of the ACC with the Civil Aeronautics Board observing.

Brazilian Line to Add Engine Overhaul Unit

Rio de Janeiro—Passo do Brasil has bought overhauling interest in a one class shop from which it will convert into a special division to handle engine rebuilding and maintenance.

Passo expects to use \$4 million annually by using the new facilities which will service 1-10, DC-7C and later jet engines, primarily for Douglas DC-6s. The plant will eventually serve other engines in engine work. Local engine rebuilding facilities to date have been restricted to DC-1 and lightplane engine sale.

Minor parts for the shop will be manufactured locally, but big components still will be imported. More

local production of components is expected later as Brazil enlarges its home air and maintenance industries.

Passo do Brasil is partly owned by Pan American World Airways.

Northeast Inaugurates Capital-Miami Run

Washington—Northeast Airlines, a regional carrier that has given a new major touchline within the past year, inaugurated nonstop service last week between Washington and Miami. Service to Jacksonville and St. Petersburg-Clearwater will be added later.

Douglas DC-6Bs equipped with radio and featuring two-seat cockpit seating are being used on the daily coast flight. Flying time is about 1 hr., 15 min.

Nonstop extended to Washington last November. To extend the coast periphery New York-Miami routes on January 1, Philadelphia-Miami service was started Aug. 1 and New York-Tampa service Aug. 18.

New Electra Orders Raise Sales to 135

Leadwell Aircraft Corp has made its first Electra sale to a U. S. local user to contract with an order from the Ohio Southern Airlines for three of the turboprops. Price with spurs is \$4.5 mil-

lion and delivery is scheduled for November and December, 1959.

This sale along with that to Cathay Pacific (see p. 45) brings total orders for the plane to 135. Last previous Electra order, covering three for Canada Industries Airways, was announced in April.

Leadwell says no exact bookings point for the plane has been established, but that it probably is within the 200-250 unit range.

Pacific Southwest plans to use its Electra in service between San Diego, Los Angeles and San Francisco. The aircraft carrier reports flight time from San Diego to San Francisco to be 71 min with the turboprop.

Allison 501 Approved To Power Electras

Washington—Civil Aeronautics Administration last week announced the certification of the Allison 501 D15 turboprop engine for use on the Lockheed Electra transport.

Last month, CAA approved the Aeropropeller 806 turbojet-powered propeller with which the 1,750 hp engine will be equipped. Prior to certification, the turboprop engine had completed 82,000 hours of development time on test stands, 75,000 hours of experimental and service flight time and an additional 50,000 hours of testing of engine components.

In-Flight Phone Service Installed

Direct improved radiotelephone service, which enables in-flight passengers to be connected to any telephone in the nation or receive calls from any telephone, has gone into service on an experimental basis in the Chicago-DePaul area. If the current year-long feasibility tests prove successful, and sufficient channels in the crowded radio spectrum can be found, busy executives may find no simple time office problems even should an airline coming at 75,000 ft.

In current tests, conducted by Bell and Michigan Bell Telephone Companies, 11 private and one government aircraft have been equipped with radiotelephone test sets.

When a passenger in one of these aircraft presses a push talk button on his telephone handset, he quickly finds himself talking to a special "airline operator" on the ground, who in turn relays the message to the party's home or number.

Notes for the new year test service depend upon location of the aircraft and the path on the ground. For example, a call between an airplane over Milwaukee and a telephone in Chicago will cost \$1.50 for the first three minutes. A call between a plane over Cleveland and a Chicago phone would be \$2.15 for the first three minutes.

Airborne radio transmitters-receivers being used in the test have been sup-

plied by A. G. Spork, Flag Division of General Motors and Minneapolis Radio and Radio Corporation of America are expected to supply units for subsequent tests.

ATA Official Says CRAF Threatened

Atlanta, Ga., N. J.—Potential of the entire Civil Reserve Air Fleet is being threatened by "certain basic" new air war, Robert L. Turner, vice president of the Air Transport Association, warned last week.

In a speech before the American Legion National Association Convention, Turner said the advances are:

- Threat of government in duplicating and paralleling routes being operated in the scheduled airlines.
- Threat of continuously rising costs of aircraft operation and necessary re-equipment programs, which, under what Turner termed the present regulatory climate in which the airlines must live, is eating away at the economic foundations of the entire air transport industry.
- Threat of a continuing State Department policy that is virtually "giving away" more rights and vital traffic routes to foreign airlines in direct competition with U. S. carriers.
- Threat of Soviet Russia which is



Boeing, Douglas Ready First Jets for Airlines

Two of America's first jet airlines are moving along smoothly here in the West Coast plant of Boeing, Douglas Co. and Douglas Aircraft Co. Boeing 707, at right on test path, is nearing completion; its engines and tail sections already installed. Plane will be rolled out this year, delivered to Pan American in late 1959. Above Douglas makes at Long Beach shape forelegs of DC-8. Length of the fuselage is 95 ft., diameter is 12 ft., 5 in.





J-41 compressor rotor, operating at several hundred degrees F., sent down, drilled and milled parts of J41F 644-4V titanium alloy.

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materials producers for this engine, supplies the MST 644-4V alloy in various specifications for fabrication . . . Ladels Co. and Wynson-Gordon Co. for spacer and disc forgings . . . Thompson Products, Inc., Eaton Manufacturing Co., Steel Improvement & Forge Co., San Haden and other parts . . . which are all furnished

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used in the only jet engines in the world operating jet engines on a scheduled basis and even do in becoming a stronger competitor for the world's air commerce.

Tanner and that, if these forces can bear to grow, they can shackle the old in and capability of the air transport industry to do the right kind of job of it as needed in an emergency. They certainly can run horses with air power," he said, "and this too weakens the link of civil air transport in the air power chain."

The government is in the air transportation business with part of its Military Air Transport Service, Tanner and Hunslett, he added that some government agencies, including the Defense Department, have recommended that certain of MATS transport airplanes be turned over to the civil airlines.

This would encourage the airlines to continue their re-equipment and modernization programs and at the same time use the government money, because civil air transport in these specific areas is known to be cheaper than military air transport. Moreover, use of the airlines would reduce military personnel and funds for combat organizations which are drawing for skilled personnel," Tanner said.

With regard to the economic status of the scheduled airlines, Tanner told the group, a situation exists where an industry is literally "cashstrapped" it will die out.

The fact is more than 80% of airlines are operating in losses in the past 18 years has been general fact, into fast re-equipment programs to bring the public the best possible service. And, the cost of everything the airlines buy and use, gasoline, aircraft, personnel, operating facilities, in the past 10 years has gone up at an alarming rate. But," he added, "the fact is the airlines charge their passengers have increased almost level."

In fact, air transportation on the major route, for pay today there is \$1.40 in 1938.

Tanner charged the government with mounting a risk of "The Rich Uncle" tax and foreign countries in allowing the same character—Monopoly. The United States government has been the same. World transport will go to use of Paris, Geneva or London, Madrid, Rome, Athens, Barcelona, Columbia and Bangkok, while the Northwest aircraft will cross the U. S. to Portland and Seattle and from there, fly over the Great Circle route to Alaska, Tokyo and Okinawa.

"The Russian planes that landed here recently," Tanner said, "have not been as successful in being in such good for the future as the jets we are building. But, we don't have any U.S.-built jet airplanes flying in scheduled operations. The Russians do and have had for more than a year. And they already have organized newer and improved versions of the Tu-104 and a much larger transport, the Tu-110. Certainly, they mean business."



GLOBAL link of the new Northwest Orient Airlines and Trans World Airlines service will be at Manila.

Northwest, Trans World Plan Globe-Circling Service for Jan. 1

Washington—Two U. S. international carriers, Trans World Airlines and Northwest Orient Airlines will join efforts to inaugurate a new around the world air route beginning New Year's Day.

A TWA Lockheed Jetstream and a Northwest DC7C will take off from New York on Jan. 1 and land in opposite directions but both will have the same character—Manila. The Trans World transport will go to use of Paris, Geneva or London, Madrid, Rome, Athens, Barcelona, Columbia and Bangkok, while the Northwest aircraft will cross the U. S. to Portland and Seattle and from there, fly over the Great Circle route to Alaska, Tokyo and Okinawa.

The two airlines will offer connecting service in Manila.

The only American flag carrier now offering global service is Pan American World Airways with routes stretching from New York to Europe, the Near East and Far East and on to San Francisco

and Los Angeles. However, the carrier does not fly over the U. S.

The TWA-Northwest hookup in Manila was made possible when President Eisenhower approved Civil Aeronautics Board recommendations extending Trans World Airlines from India and Ceylon through Bangkok to Manila.

The two carriers earlier were authorized to connect in Shanghai, but Communist occupation of that city halted plans for such service.

With the combined TWA-Northwest service, a passenger can travel around the world for as little as \$3,364.30 on lowest accommodation or \$1,877.10 first class.

Stopover at all points en route will be permitted.

Northwest provides daily flights from New York to Tokyo and three flights weekly from Tokyo to Manila. TWA schedules daily flights to Rome and Athens and will schedule two flights weekly on to Manila.

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Sud-Aviation Caravelle



CONWAY BY-PASS TURBO JET

Boeing 707 - Douglas DC-8



SHORTLINES

Northwest Airlines is scheduled to begin operating New York Seattle and New York Portland on its Boeing 747-200. The flight will be operated as a mixed passenger/cargo service. Northwest has taken delivery of seven of the 747-200s on order. The remaining seven will be delivered by the end of next April.

Gen. Peter Furedo of Massachusetts has signed a bill authorizing a bond issue of \$17.5 million for construction of three hangars and an air freight terminal at Logan International Airport. The two hangars will be built on the site of the former, which will be sold to the State Airport Management Board. There will be provisions for general rental, construction, interest on the borrowed money and service costs. Hangar 1 will be constructed for Eastern, Northeast and Trans World Airlines, the freight terminal for American. One other official statement that the facilities will bring an annual profit of \$2.5 million.

KLM Royal Dutch Airlines will begin service on New York to Caracas on Oct. 11. In 1996, KLM made over 1,000 landings in Caracas, carrying some 150,000 passengers through the closed airport.

North Central Airlines carried 57,458 passengers in August, a record for the local service industry. The airline flew more than 950,000 miles in the month, totaling 3,200 cycles. North Central also set a daily local service record by carrying a total of 2,626 passengers on Aug. 14.

Frontier Airlines established new records in August by carrying 57,508 passengers (560,000 passenger-miles), an increase of 21% in both categories over 1995.

Chicago Blackhawks Airlines carried 7,040 passengers between Midway O'Hare airports and the Chicago Loop, Meigs Field, in August for a company record. So far this year the airline has carried 28,395 passengers.

Los Angeles International Airport handled 2,150,641 passengers during the first six months of 1997. The figure represents an increase in passenger handling of 15.7%. In the first six months, the airport also handled 10, 004,139 lb. of air freight, \$1,416,594 lb. of air cargo, and 28,750,205 lb. of air mail.

AIRLINE OBSERVER

(The following column was written by American Wings Transport Editor L. L. Dwyer while attending the 11th Annual General Meeting of the International Air Transport Association in Madrid.)

Japan Air Lines plans to introduce the first of four DC-7Cs on order to Manila in April between Tokyo and San Francisco. JAL also has four DC-5 jet transports on order and expects to receive its first jet in a total of eight during the next 10 years. Seventy-five per cent of the financing program for DC-7s and DC-5s is being handled through the Export-Import Bank.

Aeroflot, Soviet-owned airline, was not represented at the International Air Transport Association general meeting although a Russian representative was present at last year's meeting in Edinburgh as the result of an invitation extended by Lord Douglas of Clydeside, then president of the association. No formal invitation was extended to the Russians this year. However, Sir William Hobbie, IATA director general, said that, if Aeroflot indicates its desire to join IATA, it will be "welcomed."

Carter Burgess, president of Trans World Airlines, was so impressed with the serious international aviation during a recent visit to Paris, Zurich, Milan, Rome, Madrid, Lisbon and the Azores that he will pattern domestic operations on standards established by the international sector. Burgess also may accept European checks in an effort to improve quality of in-flight meal service on domestic routes.

British Overseas Airways Corp. will introduce turbo-prop Britannia 312s on its North Atlantic route during the first three months of 1998. First of the long-range aircraft was delivered earlier this month. Lack of trained pilots in the sense for delays in transportation of transatlantic turbo-prop aircraft which the airline had hoped to begin this fall (AW p. 21, p. 36). One crew has been trained by British as the airline's flight training program on the 312s.

As France Ltd., a French corporation, has extended a loan of approximately \$5 million to El Al Israel Airlines to help finance the purchase of three Boeing 747-200s turbo-prop transports. The airline has been asking banks to loan for some time since the Israeli government has been unable to offer financial aid.

Trans World Airlines has asked the language barrier in Spain by naming the nickname "TWA-1" to identify the airline and as an aid to Spanish who would otherwise have difficulty in pronouncing the "W." The promotion backing the introduction of the nickname has been so successful that "TWA-1" spoken to the telephone operator will automatically connect you with TWA and will direct you to no other address when told "TWA-1."

Midwest East Airlines has begun a once-a-week afternoon service on its two routes from London to Beirut via Milan and from London to Rome, Rome and Beirut.

Cathay Pacific Airlines has ordered two Lockheed Electra turbo-prop transports to deliver in June and August of 1999. Cathay Pacific will head-quarters in Hong Kong, will operate the turbo-prop throughout its major routes in the Far East.

International Air Transport Association will hold its 11th annual general meeting in New Delhi, India, where J. R. D. Tata of Air India International will take over as IATA president for the 1998-99 term. Meeting will be held in Tokyo in 1999. Date of the New Delhi session has been set for October rather than September because of the monsoon weather conditions in early fall.

Vote to transfer IATA headquarters from Montreal to Geneva was 50 to 29 in favor of the move with an abstention, but because of the small majority, the resolution was withdrawn by a European bloc of seven airlines which had sponsored the proposal.

Great advances in design...

NEED THE ADVANCEMENT IN WEAR RESISTANCE PROVIDED BY FLAME-PLATING BY LINDE

Lockheed's F104A Strikefighter, newest weapon of the Air Force, is the most advanced airplane of its type. To give them the greatest possible resistance to extreme conditions, leading engineers (authorities of hot air valves and the F104A on Flame Plating) with machine methods Flame Plating provide the wear-resistant coating needed to withstand the high end loading and temperature stresses at these points.

Stratospheric altitudes... super-sonic speeds... extreme temperatures subject jet plane parts to almost incredible conditions of heat and abrasion. To assure perfect operation in all circumstances, bearings of hot air valves in the Strikefighter are Flame-Plated. A tungsten carbide coating, applied by Linde's unique method, is the only material used that successfully eliminates galling and provides a low coefficient of friction over the required service life of the part. With the pure Flame-Plating, practically no wear occurred. This Linde process is now a regular production procedure.

Flame-Plating is Linde's special process for protecting metal parts from wear, abrasion, and fretting corrosion. Tiny particles of tungsten carbide or aluminum oxide are literally blown onto the metal surface. Since the temperature of the part being coated seldom exceeds 600 degrees F., there is little or no risk of changes in its shape or metallurgical properties. Flame-Plated coatings can be applied from .002 to .010 inches thick, and used as coated or finished to .05 micron finish. Practically all metals can be Flame-Plated—aluminum, magnesium, molybdenum, titanium as well as copper and steel.

Your own design may be improved by Flame-Plating. Find out how, by writing for a copy of the booklet "Flame-Plating," F1065, Address: Flame-Plating, Dept. AW-04, Linde Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. In Canada: Linde Company, Division of Union Carbide Canada Limited.

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Airline Traffic—July, 1957

	Domestic Passenger	Overseas Passenger Miles (000)	Load Factor	U. S. Mail	Expense	Weight	Total Revenue Jan-Mar	For Carli Revenue in America Jan-Mar
DOMESTIC TRAFFIC								
American	698,148	443,407	47.9	1,330,339	370,381	4,194,729	53,427,302	30.4
Boeing	164,132	74,448	57.6	147,349	96,714	473,807	7,019,171	40.3
Continental	241,347	132,000	56.8	437,519	134,120	1,142,919	18,417.9	40.3
Eastern	23,773	37,324	56.8	96,844	37,776	123,119	3,814,399	40.3
Northwest	214,409	106,816	59.3	320,136	102,184	773,256	11,365,740	40.3
Republic	444,217	245,450	49.49	811,605	263,420	1,075,020	16,422,106	40.3
TWA	314,427	73,348	44.1	345,197	41,914	481,110	7,911,408	40.3
Western	412,664	23,901	39.7	26,320	16,490	59,159	1,969,100	40.3
Southwest	399,481	91,643	53.4	319,413	164,522	129,392	10,117,173	40.3
Trans World	471,136	99,119	71.9	914,860	437,863	2,272,167	36,326,169	40.3
United	272,624	457,169	49.6	8,175,451	534,516	5,994,375	8,444,116	40.3
Western	122,709	63,328	44.8	335,494	75,022	297,264	5,414,703	40.3
INTERNATIONAL								
American	13,270	10,643	49.6	15,354	589	564,180	1,966,997	76.4
Boeing	4,244	2,239	54.3	12,917	10,107	1,079,167	1,079,167	40.3
Continental-Alaska	1,320	1,320	54.3	1,320	1,320	1,320	1,320	40.3
Delta	4,505	4,505	40.7	4,505	4,505	4,505	4,505	40.3
Eastern	32,867	47,201	75.34	41,375	47,201	47,201	47,201	40.3
Northwest	7,334	2,208	33.4	14,291	4,543	391,479	391,479	40.3
Trans World	17,842	27,243	64.3	102,411	16,811	687,723	4,623,116	40.3
United	9,122	5,843	70.1	42,544	361,421	1,966,994	1,966,994	40.3
Western	116,764	124,122	66.7	177,219	5,299,208	19,464,140	19,464,140	40.3
Boeing	180,645	166,427	74.3	286,349	2,164,111	12,346,179	12,346,179	40.3
Continental	19,402	101,413	59.4	616,163	1,103,566	16,458,411	16,458,411	40.3
Delta	13,261	13,179	98.4	40,412	394,714	1,020,248	1,020,248	40.3
Trans World	32,161	66,123	66.1	720,372	720,372	16,458,411	16,458,411	40.3
United	11,483	29,007	70.8	96,682	64,281	5,117,326	5,117,326	40.3
LOCAL SERVICE								
Albany	43,974	7,727	38.4	8,319	12,077	15,723	774,164	40.4
Boeing	15,411	2,648	44.3	3,376	1,872	7,210	288,068	40.4
Continental	1,443	1,443	54.3	1,443	1,443	1,443	1,443	40.4
Delta	31,141	3,473	56.7	15,341	67,413	647,156	647,156	40.4
Eastern	15,983	3,201	24.3	3,044	15,983	15,983	15,983	40.4
Northwest	41,744	15,341	36.1	31,536	37,843	1,618,742	1,618,742	40.4
Southwest	32,178	8,119	25.3	11,016	44,774	17,321	17,321	40.4
Trans World	37,414	7,727	38.3	15,477	7,773	16,754	776,416	40.4
United	16,412	3,326	38.8	9,412	9,412	30,320	30,320	40.4
Western	4,404	7,444	64.4	7,444	4,404	7,444	7,444	40.4
Trans World	22,140	5,554	40.7	15,119	7,547	16,119	598,406	40.4
United	34,843	12,227	31.24	4,426	2,372	4,183	422,916	40.4
RAVANAIR								
Boeing	45,963	7,264	34.4	3,387	141,178	770,244	770,244	40.4
Trans World	19,380	8,528	41.6	5,191	17,389	356,440	356,440	40.4
CARGO LINES								
American Air	11,670	44,340	59.9	27,744	10,136	4,014,115	10,136,115	40.4
Boeing	7,773	39,716	100.0	7,773	7,773	7,773	7,773	40.4
Continental	2,773	32,142	82.0	79,810	22,324	4,368,404	7,449,521	82.0
WISCONSIN								
Chicago Helicopters	5,081	84.0	33.1	2,440	1,011	1,011	1,011	40.4
Los Angeles Airways	3,462	120	42.30	4,633	3,462	3,462	3,462	40.4
New York Airways	9,100	148	48.3	7,847	9,100	9,100	9,100	40.4
ALASKA								
Alaska Airlines	4,404	3,707	40.4	32,046	183,101	388,867	388,867	40.4
Alaska Helicopters	4,404	1,000	5.00	4,404	4,404	4,404	4,404	40.4
Continental	10,749	2,249	32.3	42,401	1,772,077	2,342,722	2,342,722	40.4
Delta	8,107	440	67.8	2,120	4,211	41,867	41,867	40.4
Public Helicopters	10,944	18,077	66.5	100,007	100,007	100,007	100,007	40.4

*Not available
Compiled by AVIATION WEEK from statistics reported to the Civil Aeronautics Board



General Electric Missile Alternators Feature Light Weight, Low Harmonic Distortion, Close Voltage Regulation

High accuracy and reliability under extremes of environment has been attained by General Electric alternators for missiles and advanced aircraft. A wide variety of package systems including alternator, regulator and exciter have been designed in ratings from 4 to 18 KVA, operating at speeds of 12,000, 21,000 and lighter rpm and at 800 cycle frequencies and above.

Typical of these advanced systems is the 27 pound alternator shown on test above. Rated 10 KVA with an overload capacity of 13 KVA, this 12,000-rpm machine is coupled to the drive source through an internal splined shaft. A wide variety of power motors including dc motors, hydraulic and ac turbine drives can be used.

The 115/280 V, 800 cycle, 3-phase alternator has special field construction allowing close output voltage regulation under widely varying load conditions. The unit is capable of withstanding 50% over speed at temperatures up to 300 F. Total RMS harmonic content of the alternator output is less than 1% of fundamental.

The machine's power factor rating is .80 and it has an efficiency of 85% at rated load. Forced air cooling at approximately 100 psi per minute, resulting in a six inch LAD pressure drop at one hour, enables the machine to deliver rated output continuously from 0 to 10,000 feet.

Completely self-contained, this machine requires no external excitation power. The alternator and exciter are contained in a single shaft and enclosed in one compact package.

The 800 cycle exciter supplies power to the voltage regulator which is then fed to the main alternator field in varying amounts to maintain constant voltage output. The magnetic amplifier type, voltage

regulator is completely self-contained and also self-excited. It provides less than 2% voltage regulation over 0 to 30 KVA load, 11,500 to 12,000 rpm speed range and at temperatures ranging from -20 to 300 F.

For more information or assistance in solving your missile or aircraft electric power supply problems, contact your local General Electric, Aviation and Defense Industries Sales Representative.



General Electric regulator (left) and alternator (right) combine to form a 10,000 power package rated at 10 KVA. The alternator is 9 1/2 inches in length and 8 inches in diameter. The voltage regulation is 0.5% from 0 to 30 KVA. Total RMS harmonic content of the alternator output is less than 1% of fundamental. The generator has an efficiency of 85% at rated load.



New, Self-Contained Missile Accessory Power System Gives Both Hydraulic and Electric Power

A completely self-contained, General Electric auxiliary power unit is now available to provide independent hydraulic and electric power for missile systems. A new test model based on this advanced design uses two alternators and a hydraulic pump to furnish 1200 watts of 800-cycle, 115-volt, 3 phase ac power, 100 watts of 2800-cycle, 115-volt, single phase ac power and hydraulic pressure at 2200 psi and 4.75 gpm. Frequency control of both electric power systems is within $\pm 1\%$ and voltage control within $\pm 5\%$.

A complete test weight 25 pounds or less and all components, including turbine drives and fuel tank, are contained within two cylinders, each 4 1/2 inches in diameter and 13 inches in length. These cylinders can be mounted side by side or in line.

A monopropellant fuel tank at turbine speed opens the turbine wheel and provides the drive power for the alternator and pump. A cartridge igniter firing activates the fuel and also provides a starting ac

induction boost to bring the unit to rated speed and output within a half second. The fuel tank contains an integral pressure control allowing hot gas from the decomposition chamber to activate a stop piston. This eliminates the need for pressurization, pumps or plumbing external to the unit.

The frequency control is obtained with a load control loop consisting of a frequency detector, a leading element and pressure loading resistance. Constant speed is maintained by placing a loading torque on the turbine shaft to balance changes in load demands.

The advantages of this advanced missile APU can be easily applied to your present or future problems. The modular design allows modification for a wide variety of applications by attaching needed hydraulic and electric components rated in regard to a choice of turbodrives. Fuel tank use can be varied to provide operating cycles from 20 to 247 seconds depending on the turbine and output components used. For



New, General Electric modular APU shown above is advanced design combining several electric and hydraulic power sources into one compact, completely self-contained unit. This particular version, with two electric power sources, weighs only 25 pounds, including fuel.

more information on this advanced missile power system contact your local General Electric, Aviation and Defense Industries Sales Representative.



Whether 10 or 10,000 hours, General Electric pulse-forming networks can help solve the life time of your specific application. Thorough understanding of test data helps General Electric engineers meet your special conditions.

How 13 Years' Application Experience Can Help Solve Your Pulse-Forming Network Problems

Since 1946, General Electric has been designing, building and testing capacitor pulse-forming networks of practically every type. A wide variety of data and experience has been accumulated on temperatures, voltages, distortion and the other factors that affect service life and reliability.

Today, this wealth of recommended data and experience can help solve your pulse-forming problem. General Electric pulse-forming networks can be designed and produced to meet service life requirements of 10 to 10,000 hours or more. Pulse width, rise time, number of pulses per second, ripple, and most other measurements can be met with solutions based on accumulated data and experience. Units are available with networks and test indications based on forced air convection or air also available.

Quickly manufacture your General Electric pulse-forming networks for dependable reliability required for missile applications. Capacitor networks are constructed of low loss kraft paper and high purity aluminum foil. Inductance coils are wound on shielded ferrite for stability throughout the life of the unit. Highest quality materials are used for impregnation. Service, hermetically sealed units help protect all components.

For more information on pulse-forming networks, network prices in thousands of applications, contact your local General Electric Aviation and Defense Industries Sales Representative or write for Literature GEA 990, General Electric Company, Section 220-105, Schenectady 5, New York.

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Photographing Super Sabre Loop

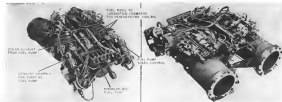
THIS SEQUENCE of the supersonic North American F-105D in a full loop was shot by North American Staff Photographer Gene Rowell. Rowell used a Gosselin K-25 sequence aerial camera and Super X film. Exposure was 1/100 sec. at shutter opening of F-13. Dotted line shows flight path of the F-105 photo plane. Stars indicate position at which each exposure was made. At points where the photo plane was pulling 4Gs the 20-lb camera weighed 36 lb. Loop was flown just off the coast at Santa Barbara, Calif.



INSIDEVIEW Left Pilot Zeno Hapkins flew the F-105D (above) during the loop photographing session. Gene Rowell (below) demonstrates the desired maneuver for the loop picture to Capt. Pat Hunsomaki, at right, and Hapkins. Capt. Hunsomaki is USAF test pilot, flew the TF-54 Sabrejet camera plane. For best on-track photo results, Rowell says, distance between aircraft should be 75 to 100 ft. Gap wider than 125 ft. is almost useless.



AERONAUTICAL ENGINEERING



NAPIER SCORPION two-bore inlet package mounts fuel burn and accessories above combustion chamber.

British Emphasize Reversers, Silencers

By David A. Anderson

Functionally—more thrust noise quickly and possibly reversed, was the dominant theme of the engine display at the 15th Society of British Aircraft Constructors exhibition.

New Powerplants

Half a dozen new powerplants shown for the first time included:

- Two 1,000-shp gas turbines on gins developed in private ventures by Armstrong Siddeley Motors, Ltd.
- Bristol Oxa supercharged turbo prop rated at 5,250 shp for takeoff and completely cooled as a prototype axial turboprop.

• Rolls-Royce RB 305 turbojet with advanced, high thrust/weight ratio, developed for vertical takeoff concepts including the Short SC 1.

• Thrust reverser by Rolls-Royce designed for the Avon RA 79 turbojet for the Bristol's Comet IV.

• Computed noise noise reduction unit also by Rolls-Royce. Now a production item for the BA 79 installed in the Comet IV.

• Exhaust silencers developed by Bristol Aero Engines, Ltd. for its Olympus engines now powering the Avon Vulcan bomber and shown in the Olympus Combson firing test bed.

Both silencing units and the thrust reverser surprised observers with the apparent efficiency of their operation.

The new Armstrong Siddeley engines show common components wherever possible to cut down on development time and cost. Engines have a two-stage centrifugal compressor driven by a two-stage turbine, plus a single-stage power turbine driving either a rotor shaft or a propeller through the suitable reduction gear. Combson's chamber design a also common to both.

The P. 182 engine, for fixed wing installation, develops 1,075 shp, with Armstrong Siddeley. Specific fuel consumption is down to 0.657 lb./per

shp per hr. and the specific weight is 0.44 lb. per shp. Maximum engine diameter is 30 in.

The P. 181 has been developed for drive rotary wing aircraft, and its output is 950 shp. Specific fuel consumption is higher at 0.75 lb. per shp per hr. and specific weight is 50 lb./shp. Engine diameter is also 30 in.

Reverser for Transports

Rolls-Royce says its thrust reverser has been designed to fit on the Avons for DH Comet IVs and on the Comets for the Boeing 747. No weight, cost, or thrust reduction will be quoted by the company, but they claim these will be some of each. The reverser consists of a pair of nozzles which fit into against the walls of the engine tailpipe when not in use, and which swing together when thrust is reversed is desired. The closed nozzles divert the thrust exhaust blast out through slots at a forward angle. Nozzles can be swung and swung to avoid blowing the heated gases on sensitive portions of the airplane.

The computed silencer module developed for the Avon is based on the ideas of Rolls-Royce's F. B. Combson, who patented the idea of a series of concentric pipes in a silencing unit.

The silencer unit consists of six small triangular bays inside the tail pipe. These are distributed to take the place of the poppet valve at the end of the tailpipe. Cooling air from the first stream is pumped through exhaust holes in the square area of the exhaust.

Flows on the Comet III, these ideas now proved that jet engines can be quieted. Combson's noise reversal is the leader in the approach, but this is an enormous improvement created by re-



ARMSTRONG-SIDDELEY P. 182 for fixed wing aircraft is nearly as cool (top) and P. 181 for rotary wing application (bottom). P. 182 delivers 1,075 shp, P. 181 output is 950 shp.



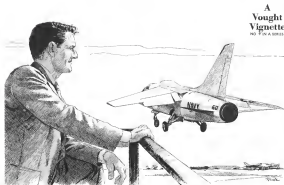
ROLLS-ROYCE thrust reverser diverts exhaust gases through bays openings. Attention on shows with director fully opening (middle).



and in normal position (above).



ROLLS-ROYCE RB 305 was developed for multi-engine VTOL and STOL aircraft. The one installed in Short SC 1 VTOL, now undergoing initial hovering tests.



The electronics engineer who had an ear for harmony

A
Vought
Vignette
NO. 7 IN A SERIES

Vought fighter development is more than a matter of airframe. Electronics play an increasingly vital role, too. Gray Redmond showed how well the two efforts can harmonize in an engineering climate that encourages a man to reach beyond his own field.

Gray was named Electronics Project Engineer for the Crusader, and a posthumously promising choice he was. An electronics specialist by assignment and inclination, he held both E.E. and M.E. degrees. He knew the complexities of electro-mechanics from work on earlier systems. And his constant proddings into related areas had marked him especially for the job. Gray's wide knowledge bridged the gap between airframe and electronics.

To many two-headed problem involving electronics and airframe, Gray sought the answer that would best serve both interests. Though Crusader stabilization took most of his attention, his curiosity was contagious.

Electronics specialists confined with propulsion men, for example, on coding the Communications-Naval-Identification package. Together, they found a neat answer in the Crusader's air conditioning system. Aerodynamics, engine and electronics engineers reached an ingenious compromise on the location of total accelerometers.

Everywhere in the Crusader, electronics meshed with airframe requirements. Stabilization equipment, sensors and other systems developed in Vought's own labs were tailored to fit from the start. Patchwork items got the same treatment, often requiring major improvements in the process.

Standards were high — higher in resistance to environment in some cases than had ever been asked before. And the Crusader project was not held up by an electronics war!

In fact, the harmony that Gray Redmond symbolized had a distinctly opposite effect on Crusader development. The fighter raced from proposal to Fleet service faster than any comparable aircraft ever had.

Expansion of electronic development capability at Vought is creating a unique role for the electronics engineer. Here he expertly combines advantage, opportunity to incorporate the most advanced components, and close contact with complete modules and fighters.

For details on select openings, write to:
C. A. Reitz, Supervisor,
Engineering Personnel Dept. A-18

CHARLES V. VOUCHT AIRCRAFT
NEWTON, MASS. 02459



TUBULAR combustion chamber used in Regal Aircraft Establishment's rocket development program.

ductors of the turbine below which axially loads most of the compressor load.

Once the engine is shown as an answer, he believes that the race drops as suddenly as if the engine had been out.

Helicopter Turbine

Naper's first turbine Guelie got turbine, flying in the Westland Wessex and should be installed in the first prototype of the Bristol 182 utility helicopter, has excited interest among naval aviation. This engine has been running less than two years, and has run through three complex, but unusual type tests in succession. Then the engine ran at full power for 150 hr without removal from the test stand. One institutional advantage of the

Guelie is its adaptability to singularities because it can be placed in any position from horizontal to vertical. The Wessex installation racks the engine 15 degrees from a horizontal reference. Bristol will place one Guelie at 7 degrees and the other at 15 degrees from the vertical in the Vape 168.

Naper's stand also showed a model of a modified Super Constellation converted to use four of the company's Elmer turboprop generators. Announcement of a contract between Naper and a naval airline for such a conversion is expected to be made shortly. Meanwhile Naper has signed a contract with West, the Glasgow, Ohio, for conversion of three of its Constables, with a promise of 17 more at the first three work out as expected. Bristol proposes a complete installa-



Hispano Suiza Aircraft Guns

Hispano Suiza Type 325 30 mm aircraft gun (middle) has muzzle velocity of 1,310 ft./sec., weighs 240 lb., including fire mechanism. Type 318, a 75 mm gun, has muzzle velocity of 1,495 ft./sec. and weighs 145 lb. Pump rate at both is 1000 ft./min.



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Aerial View - See How Beautifully Valve Cuts



Westinghouse metal miracles boost jet engine performance 15%

Turbine "hot end" parts, made from dual molybdenum, are increasing jet engine efficiency up to 15% by permitting higher turbine operating temperatures. Developed by Westinghouse research scientists, this new method of coating molybdenum to prevent high-temperature oxidation has proved successful during extended engine testing of "dual-moly" parts at temperatures above 2000°F.

Development of this protective coating—which remains intact and effective after molybdenum alloy sheets or shapes are formed into parts of complex shapes—is a part of the advanced metals research program at Westinghouse. The Aviation Gas Turbine Division is helping to keep America strong by applying this coating and other new research developments to create better and better jet engines for the defense of America.

Take advantage of Westinghouse's ability to engineer, develop and produce equipment for America's defense. Contact your Westinghouse Defense Products sales engineer, or write Westinghouse Electric Corporation, Aviation Gas Turbine Division, P. O. Box 286, Kansas City, Missouri.

4-2077



The 3D shape turbine parts were defined in red, were chosen for initial testing as they are subjected to the highest temperatures and are most susceptible to thermal shock.

YOU CAN BE SURE...IF IT'S

Westinghouse





Handley Page Viscount bomber despite its cluttered nose has exceeded Mach 2. Viscount is in production and fast upgrade is expected to be turned into this year.



British Bombers, Fighters Exhibit Design Revisions

Arm Vulture B-1 has revised bomb-aiming position with bracket over window, below cockpit. Core extension also is cut for decreased spin rate. Vulture is now in spinless attitude in one group of British Conquest.



Handley Hercules (left) shows looped tailpipe being tested as a possible modification change on the new two. Wingtip pod of Fairy Fairy target aircraft (right) carries five wide angle cameras to record late and new status of test results.



Gloster Javelin with Fairbanks shows first air intake, high-speed fuel pipes. First is being used in development work.



Drag chute and brakes open, Vulcan bomber demonstrates at Fairbanks (above). Vulcan landing down (below) shows wing root gear-up, four in halves and electric deflection. Critical center curve is fuselage about midway out on the wing.



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Ground Test Load Cycles Called Invalid as Fatigue Life Measure

By Russell Hawkins

Los Angeles—Predictions of the fatigue life of an airplane in terms of hours in load cycles on the basis of ground tests were termed invalid by Emerson H. LaBontard, Douglas Aircraft structures engineer in a discussion here before the Institute of the Aeronautical Sciences of the DG's fatigue resistance program. The ground test is designed almost entirely by fatigue curves and even parts of structure are physically tested and over designed relative to the static load levels. LaBontard said Douglas has used a "computer" fatigue testing technique to learn whether a specimen structural component will be satisfactory relative to some equivalent structure known to be successful. This is a traditional laboratory method of checking a test

specimen against a control specimen of known characteristics.

Fracture Effort

Douglas abandoned as fruitless the claim to set up approximations of the number of cycles to the amount of time required to make a component fail due to fatigue. LaBontard said that its critical scattering of test results was even such a broad base that meaningful approximations have little use. The quantitative application of test results should at least await the growth of much more experience in the field, he said.

Other objections to making qualitative applications of test data are the difficulty of making a complex structure dissimulate, especially under small loads and at low frequencies, and the difficulty of explaining actual flight



Gen. Power Flight-tests B-58

Gen. Thomas S. Power, commander in chief of SAC, emerges from B-58 following test flight. Note use of disposable hook post along benching bridge.

loads. The only realistic way to get the equivalent of 10 years of flight loads would be to run 10 years of laboratory tests and would call for extremely sophisticated equipment. Accelerated testing calls for a certain amount of cheating on loads and other conditions which may have unpredictable effects on results, LaBontard said, and as the acoustic frequency range it is nearly impossible to accelerate test rig service.

Critical Structure

Critical structure from the largest standpoint usually includes a joint of some kind. One form of the Douglas comparative testing method is to check such a structure against a similar unjointed structure. If it can withstand the same test for an approximate equal number of cycles, it can be considered noncritical. If fatigue cracks appear substantially before they do in the unjointed specimen, the part must be redesigned.

Another form of comparative testing used is to check a specimen against the equivalent test of a proven airplane such as the DC-6. If each unit is tested at its appropriate structural stress level, LaBontard feels it is reasonable to assume that a DC-6 specimen which matches the fatigue resistance of the DC-6 part will prove out successfully in service.

This approach has known weaknesses. For instance, if a part has given trouble in the proven airplane and the equivalent part in the new airplane tests out better, it still is impossible to say the new part will not give trouble in service.

In such an ambiguous situation, some other approach must be used.

Statistical Validity

Any test of course must be repeated often enough to give more size of its statistical value and validity. On the DC-6, the maximum number of tests on one type of specimen has been four and usually at its peak height. The proportion of the whole airplane to be used in a test specimen is a compromise. The advantage of the small specimen is ease of experimental control and low cost; the disadvantage is that the specimen must be balanced against the advantage of getting a relative reduction of parts in a large specimen.

Douglas has used a system progressing from very small components to very large ones. The present part of pre-pressured cabin structure testing on the DC-6 was done on 6 ft. x 10 ft. "one piece." A specimen of this size is large enough to include several segments of the "step-joint" fatigue design.

This means that statistically all structural instructions can be proved while still and time required to build



developed for extreme temperature ranges in supersonic jets...

Stratoflex "Super-T" hose assemblies are designed for extremely high and low temperatures. Stratoflex "Super-T" tube is extruded from specially compounded Tefflon® and reinforced with high strength, corrosion resistant stainless steel wire braid. "Super-T" is unaffected by fuels, petroleum or synthetic base lubricants, acids, solvents, alcohols, and coolants. It is non-inflammable and the shell and operating life are proportionally unlimited to provide long and trouble free service.

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Stratoflex "Super-T" hose is available in standard sizes from 1/4 in. to 24 in. It is factory assembled, fittings permanently attached—no crimping required, slip connections or lightweight types. Special assemblies, made to your specifications. Write for literature D-2, Stratoflex.

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for Hi-Strength at Hi-Temperature the Cherry "600" Rivet*



*Water based and passing

To meet the design requirements imposed by extremely high-speed aircraft and missiles, the Cherry Rivet Branch and development department has introduced the "600" A286

stainless steel blind rivet. Data on the strength capabilities of the "600" rivet is available from Townsend Company, Cherry Rivet Division, P.O. Box 2197-N, Santa Ana, California.

CHERRY RIVET DIVISION

SANTA ANA, CALIFORNIA

Townsend Company

DESIGNS, MANUFACTURES, AND SELLERS

in Greater Portland & South Manufacturing Company, Inc., Everett, Wash.

the specimens still is within reason. Lubricated and then compressed testing on this rivet is more applicable for costly and less time consuming than tank testing as stress applied. The mean value of the full scale tank test is in proof of the validity of compressive testing.

Missed Turn

Lubricated displacement of the lower wing of the test fatigue life. This term implies that there is such a fatigue crack in which the airplane suddenly becomes unstable. He said there is no such thing, the Comet accidents notwithstanding. These were caused by rupture, decomposition as stated along fatigue cracks. Either an explosion or fatigue cracking could have occurred alone, but a catastrophic failure due to fatigue alone is unlikely.

Lubricated suggested that fatigue life be defined as the number of hours logged on the airplane before the cost of repairing fatigue cracks makes the airplane unsuitable to operate. It should be regarded as a maintenance problem rather than a safety problem.

Explosion resistance and fatigue resistance of the fatigue are related design problems since they cause together with the advent of higher penetration levels in the high altitude turbine powered transports. The last generation of piston engine transports were so heavily explosion proof because the internal-exterior pressure differential would exceed 15 psi and the air seal structural strength levels exceeded the stresses imposed by that level of penetration.

This is not true of the new jet transports. The DC-8 was built to a maximum altitude of 5,000 ft. as a commercial pressure altitude of 45,000 ft. This gives a differential of 12.5 psi.

The explosion structure was reserved to limit the spread of local explosions and prevent an explosive failure from gaining headway. It grew out of an NACA study showing that a structure could be non critical at a specified ratio of skin area to frame area.

5,000 Ft. Blast Fence Erected by USAF

Jet exhaust deflector fences over 5,000 ft. long has been erected at Castle AFB near Merced, Calif. It deflects exhaust, heat, fumes, debris, and in some degree, noise generated by jet aircraft exhaust.

Called Model CV 13-2 Jet Blast Screen, the fence is built in 10-ft. long, arch-like sections which stand 12 ft. high when erected at a 30 deg. angle to the horizontal exhaust flow. The 15 curved, lateral vanes in the fence turn the exhaust blast through

90 deg. into a vertical column of air. Positioning the fence at a 60 deg. angle towards the aircraft allows unobstructed movement of the high velocity blast in an upward direction, thus eliminating pressure build-up in front of the fence which would cause blast spillage over and around the fence.

Fence is available in welded or bolted construction and can be applied on various lengths, depending on type of aircraft with which it is to be used. Screen was designed and engineered by Boeing Airplane Company and was fabricated by John Davis Division, Ford Machinery & Chemical Company, San Jose, Calif.

Inlet Diffuser Reduces Liquid Rocket Dilution

A long standing technical problem having the efficiency of liquid fuel rockets using pressurized propellant tanks has been solved according to Rockwell's officials.

Nitrogen gas, usually used to pressurize propellant tanks when pumps are not used in a rocket motor system. The gas at about 4,500 lbs. per square inch, usually with liquid oxygen, is widely used oxidizer. The LOX is contained and its effectiveness greatly reduced. Large thrust losses are attributed to this condition.

Stanley Greenfield, a Rockwell engineer, is credited with developing a perforated inlet tube which draws the nitrogen as it enters the LOX tank. Instead of entering with the oxidizer it becomes trapped at the top of the tank and then comes into contact with the LOX slowly. It is claimed that 10 to 20 times less dilution takes place and that the weight of a single stage, the section can be reduced up to 30%.

Automation Trend

Flight/Fuel/Air Control—One of the steps in the development of the new aircraft is the processing of data for a vehicle on liquid control in the human hand. It makes too many mistakes.

The flow of information from combat units to the command and back again must be as unobstructed as possible with as little human intervention of writing, punching or other handling of papers and cards.

To achieve this, there must be a new degree of automaticity and simplicity in the design of parts and components. Thus an action occurs when the commander's command is designed for a unit control more than 300 digits. Even a command more than 300 digits is a command more than 300 digits. Even a command more than 300 digits is a command more than 300 digits. Even a command more than 300 digits is a command more than 300 digits.



Prototype of new joint for a Cherry Rivet. The joint is shown in the Cherry Rivet Branch and Development Department.

Special Tools

for building tomorrow's aircraft
being developed today by Cherry research

Higher speeds and operating temperatures of aircraft, missiles and rockets of the future demand fasteners with greater resistance to the stresses imposed upon them than ever before.

Installation of these high strength Cherry Rivets and Lock-bolts will require new special tools such as those now in the development stage in the Cherry Research and Development Department.

This activity—encompassing the needs of the aircraft industry and the military—is an old story with Cherry. For years, Cherry engineers and technicians have de-

voted themselves to a single objective—the production of better aircraft fasteners and the tools for installing them.

Tools for solving specific problems—tools for efficient production fastening—all are developed and produced in the Cherry plant at Santa Ana which is devoted exclusively to the production of fastening equipment for the aircraft industry.

For information on the most efficient fastening methods for your operation—write Townsend Company, Cherry Rivet Division, P. O. Box 2197-N, Santa Ana, California.

*United States Patent 3,111,412; 3,111,413; 3,111,414; 3,111,415; 3,111,416; 3,111,417 and 3,111,418

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Silastic coated fabric is used as an outer covering on the air ducts of the D-120A jet engine. The ducts are tested for their ability to withstand the heat and stress of the engine's operation. The ducts are tested for their ability to withstand the heat and stress of the engine's operation. The ducts are tested for their ability to withstand the heat and stress of the engine's operation.

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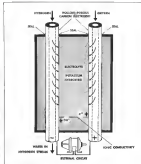
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AVIONICS



NEW FUEL CELLS, which directly convert hydrogen and oxygen into electricity without combustion or moving parts, operate at moderately low temperatures and at atmospheric pressure, unlike previous fuel cells. Device was developed by National Carbon Co.

Gases Provide Silent Power Source

By Philip J. Klein

Fuel cell which directly converts hydrogen and oxygen into electricity with out combustion or moving parts, and operates at moderately low temperatures and at atmospheric pressure unlike earlier fuel cells, has been developed by National Carbon Co., division of Union Carbide Corp.

Hydrogen-oxygen fuel cell offers attractive advantages over engine-driven generators or storage batteries for certain remote applications or in new combat areas.

Nearest Unit

Unlike engine-driven generator, new fuel cell is compact, produces no tell tale exhaust to give away its position.

For moderately high power loads of long duration, fuel cell and its hydrogen supply are more practical, lighter than equivalent storage batteries. Furthermore, fuel cell can be instantly "recharged" by replacing empty supply cylinders.

National demonstrated its new fuel cell last week at Army's Electronics Proving Ground, Ft. Monmouth, N.J., using it to power Army's new portable radio

used in infantry to detect infiltration of front lines.

Concept of the hydrogen-oxygen fuel cell dates back at least 120 years, and successful fuel cell was produced some 70 years ago. Interest then shifted to steam turbine-dynamo generator for producing electricity, but only recently been advanced as the fuel cell.

British investigation of hydrogen-oxygen fuel cells began around 1931, but interrupted by the war, was resumed at University of Cambridge in 1946, under P. T. Bacon. Bacon's activity is indicated by papers published in 1947.

In this country, Pittman-Moore division of Universal Winding Co., Jamaica, N. Y., is developing fuel cells, using Bacon principles, for undisclosed government agencies.

Several Advantages

Compared to previous hydrogen-oxygen fuel cells, National Carbon claims some advantages for its design, at least in some design areas which may or may not be overcome.

National's fuel cell can operate at considerably lower temperature, 75-80°C, compared to 180°C or higher needed for

previous designs. Furthermore, it can operate at near-atmospheric pressure whereas former fuel cells operated at pressures in range of 680-800 psi (gauge).

Company's Dr. George E. Evans, assistant director of research, says fuel cell can be operated with ordinary air and commercial-quality hydrogen, among logistic problems, but at most sacrifice in output. Operation with air does not substantially shorten life, Evans says, and sometimes reportedly runs a problem with previous hydrogen-oxygen fuel cells.

Efficiency Evaluation

Volumetric efficiency (output power per unit of cell volume) in National's cell is only about 10% of that of the British and Pittman-Moore fuel cells, according to published data and figures reported by company spokesmen. However, volumetric efficiency increases with operating pressure which indicates that National may be able to match the performance of other cells by operating at higher pressure.

Hydrogen-oxygen fuel cell is one of several types under investigation for direct conversion of chemical energy to electricity without combustion; others

PRATT & WHITNEY AIRCRAFT ENGINES
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Aircraft operators of private planes, executive transports, military aircraft—regularly use Pacific Airframe's unstaffed parts-service facilities across the Western States. PAC's large stock of parts and accessories are warehoused at Burbank, Chino, Denver, Kansas City, Oakland and Seattle airports.

Among the corporate fleets that rely on P&C and its dealers for engine, aircraft and accessory supplies and maintenance are Sears, Roebuck, U.S. Steel, Union Carbide, Rockwell Int'l. and Bethlehem Steel.

world's decision to contract them to set engine overhauls rather than to set up their own 2-27 overhaul shops at their new Los Angeles base. Thousands of valuable man-hours that would have been required to train personnel, plus the capital needed for special 2-27 engine test and overhaul equipment, are thus saved by Continental.



PAC AT BURBANK continues to provide complete modification and remanufacture of executive and corporate aircraft. In addition, long-term overhaul contracts from commercial air carriers

PRODUCTION OF LEARSTARS — unsurprisingly the best, most sought-after extensive transport at the jet today — continues at an increasing pace at P&O's Per Aero subsidiary in Santa Monica. In addition, PanAero provides complete repair and maintenance service for Lockheed and Learjet aircraft.

Contact your nearest PAC facility for complete information on parts, accessories, engines, aircraft overhaul, overhaul aircraft maintenance. Address: Planning Service for control of parts and accessories and engines.

In one configuration, hydrogen-oxygen fuel cell consists of two hollow porous electrodes sealed in container filled with electrolyte, usually potassium hydroxide dissolved in water. Natural and carbon electrodes treated with special catalysts. Partridge-Moore and British reportedly use natural nickel electrodes.

Dorlandian Lee

Voltage generated across electrodes of a single fuel cell is about one volt, depending upon the cell efficiency and current being drawn. Voltage drops with increasing current (load). Although a number of fuel cells can be connected in a portable series-parallel arrangement



Airborne Character

Microbar versions of Chameleon methods are tube, suitable for displaying tube targets and data link information in the form of letters, numbers or symbols, has been de-

described by Stannard-Cutler. New Character has five-inch feet, common only 178 in long, compared to three length of previously available 7-in. feet tubes. Forcing is accomplished by internal shock-resistant liners, eliminating need for external braces and converging rods. External deflection rule is required to position characters on tube face. Characters are approximately 0.1 in. high.

Subcontract: PACKARD ENGINEERING CORP., Santa Monica, Calif.,
Furner Inc., Burbank, Calif., Fluor Daniel, Inc., Linden, N.J.



New Passive Refrigeration works at Honeywell components such as the automated sub-systems shown here, in refrigeration in its simplicity. Armed with sub-systems, Honeywell can put a packet of special material which is solid at normal temperatures. As super heat, it becomes a semi-solid and stands up for heat without changing temperature (heat of fusion). This keeps the operating temperature in a safe plane in spite of transient super temperature encountered in extreme speeds.

PASSIVE REFRIGERATION—

new shield against super heat

Simple, lightweight, non-mechanical—it keeps precision controls at peak performance for up to 30 minutes at ambient temperatures of 500 degrees.

It's hard to imagine a more powerful weapon in aviation war on land than a substance that cools with the simplicity of a cake of ice. Self-contained, no moving parts, no auxiliary equipment to add weight to missiles and aircraft.

It is this principle of Passive Refrigeration (cooling without external power source) that Honeywell Aero engineers have put to work protecting components used in their advanced guidance systems.

With Passive Refrigeration these components are able to withstand temperature plateaus as high as 500° F. And in the near future you may find Passive Refrigeration cooling components in advanced interceptor aircraft and supersonic missiles.

Passive Refrigeration is another example of Honeywell Aero's continuing contributions to the research, development and production of advanced systems varying from guidance to fuel management, from engine control to flight stabilization.

If you are working on projects where super heats will be encountered, perhaps Honeywell Aero has the answer to your problems. Honeywell's Aero engineering group is prepared to develop components or systems utilizing Passive Refrigeration for any type of missile, rocket or aircraft.

Contact Minneapolis-Honeywell, Aerospace Division,
3600 Ridgway Road, Minneapolis 13, Minnesota.

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Aerospace Division

American Girl Breaks Russian Record In The Aero Commander 560-E



THE PILOT: 26-year-old Miss Jerris Cobb of Ponca City, Oklahoma. . . a slender, attractive blonde who has been a licensed pilot since her 16th birthday



THE PLANE: A standard production model of the new Aero Commander 560-E, a 7-place twin-engine executive transport with a 1435-mile range, plus safety fuel reserve



THE ROUTE: From Guatemala City to Oklahoma City, a 1525-mile non-stop solo flight to beat the Russian record of 1335 miles for planes in the 3,555-pound to 6,615-pound class



THE NEW RECORD: A 1525-mile non-stop solo flight in eight hours and five minutes. Average speed was 190 mph. Remaining fuel, 30 gallons.

This story of superior range, flying comfort, high speed and ease of handling only begins to illustrate the reasons for Aero Commander's enthusiastic acceptance by pilots and executives the world over. Send for free brochure.

*Supervised by Aircraft Industries Association



560-E - 560-S

AERO DESIGN & ENGINEERING CO • TULARE AIRPORT • P. O. BOX 118 • BETHANY, OKLAHOMA

San Diego) Occupancy is expected by early 1958.

• **Aeroback Electronics Corp.**, Norbeth, Penna., is name of new firm which will specialize in automatic and detection systems. Company is headed by Louis L. Aeroback, former director of special products division of Westinghouse Corp.

• **Chicago Aerial Industries, Inc.**, has formed a Composites division to manufacture and market precision fiber-reinforced components. New division, headed by Gordon B. Rosenzweig, will be located at 10355 Franklin Ave., Franklin Park, Ill., where new facilities there is completed. Initial product will be a line of precision petrolium nozzles.

• **Potter Instrument Co.** has opened new 25,000 sq ft factory and office building in Plattsburgh, L. I., N. Y. on Sunrise Blvd.

• **System Corp.**, maker of remote instruments and automatic control systems, will build 15,000 sq ft plant in Concord, Calif.

• **Gilman Electric Co.** has moved manufacturing operations and office from Pittsburgh to new 25,000 sq ft plant in Delmont, Penna., located on Old William Penn Highway.

• **Applied Science Corporation of Princeton (ASCOPE)** has opened south western sales and service center in Dallas at 4518 Greenville Ave.

• **Leady Manufacturing Corp.**, Glen Head, N. Y., has purchased Ryan Industries division of Detroit from Testco, Inc. New acquisition, which will operate as a Leady division, manufactures countermeasures equipment.

WATER FILTER CENTER

• **R-W Dues Other Ltd.-Rams-Woodbridge Corp.**, widely known for its role in technical director of Air Force ballistic missile program, seeking to counter possible relative opinion that it intends to compete with aircraft manufacturers for missile prime contractors. R-W officials are visiting airport security companies to explain that company wants to work as a major aircraft subsystem contractor. R-W is sub-contractor to McDonnell Aircraft Co. on Quail, new countermeasures missile.

• **Frederick New Endeavor Tele-Telecom**, new microwave tube which reportedly is five times more efficient than existing beam-wave oscillators,

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Every day, every part of every jet engine built by the Aircraft Engine Division of Ford Motor Company is subject to the closest inspection by our skilled craftsmen—like this level gear being checked by an optical comparator. This unrelenting demand for quality is a trade-mark of all our volume production methods.

Such a mechanism as a J37 jet engine, with hundreds of high-speed components, requires highest skills of production for safe, dependable operation.

The finished product of our J57 jet engine-makers is the power behind some of the latest "Century series" fighter models, the B-52 macrocontraction heavy bomber, and KC-135 jet tanker transport.

These Ford-built jet engines help the Air Force maintain its vital role in the defense of our freedom.



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electronic altitude controllers for Hughes Aircraft Co. as a \$1.9 million contract.

• **Monopole-Honeywell** has received under the transferred full-measuring equipment from The Martin Co. for use on its PGM-2 jet patrol bomber.

• **Collins Radio Co., Cedar Rapids, Iowa**, has been awarded an \$5.5 million contract by Canadian Department of Defense for production of AN/ARC-52 UHF nebolic transmitters. Canadian version, to be called the ARC-552, will be produced at Collins' Toronto plant.

• **Huffman Electronics Co.** has received \$180,000 contract for closed-circuit television monitoring equipment to be used in testing rocket engines and motors at Martin's Titan ballistics missile plant in Decatur and the Army missile center in Huntsville, Ala. Contract includes for 24 systems at Decatur, 22 at Huntsville, with capacity capable of withstanding rocket engine salt blast.

NEW AVIONIC PRODUCTS

Components & Devices

• **Unidirectional squaring mechanism** for use with mechanical and electro-mechanical analog computers weighs 10 oz. with aluminum casing, 28 oz. with steel casing. Two squaring units, with differential, can be supplied in modules, using Guard Line of Quarter Squares. Squares measures 3 1/2" x 1 1/2" and multiplier 3 1/2" x 1 1/2". Manufactured by **Block Instruments Corp.**, 111-01 14th Ave., College Point, New York.

• **Steadystate motor**, type 18-A, 8125-01, is single phase two capacitor type operating on 400 cycles. Size 1 1/2" motor runs at 12,600 rpm and has 0.85 or 1.0 pull-out torque with 23 watt



power consumption. Unit can be connected as a two phase motor, as a single capacitor type, or as a capacitor resistor type, and is sold in steel MJE 5272. It weighs 1.4 oz. and is furnished with gaskets, type draft. Manufacturer: **John Oster Mfg. Co., Racine, Wisconsin**.



facts about Flexflyte®

that will help you solve your aircraft ducting problems

What is Flexflyte?
A lightweight, reinforced ducting made of a spring steel wire built covered with coated fiber glass or a cotton fabric and bonded with a fiber glass cord.

What are its applications?
Flexflyte is designed for use with venting, defrosting, de-icing and hydraulic systems.

How flexible is Flexflyte?
It will take tight turns at any angle up to 180° without buckling. No elbows or fittings are required.

What are its temperature ranges?
From minus 120° F. to plus 650° F.

What about Flexflyte's resistance to abrasion?
It is highly resistant to abrasion, especially when coated with FE-206 which has more than 300 times the abrasion resistance of any tubing of its type and weight.

Is it flame resistant?
Flexflyte has exceptionally high flame resistance and will not support combustion.

What pressure will Flexflyte handle?
Internal working pressures up to 70 psi and external working pressures up to 15 psi, depending on type.

What about installation?
Flexflyte is quickly, easily installed around corners and equipment parts by means of metal clamps. It is also available with special clamping or reducing ends, either cylindrical, rectangular or polygonal.

Can Flexflyte be engineered for unusual applications?
Yes, in every special shape, fabric, coating, connections, lengths and diameters. Our special Sales-Service Department, working with customer's machinery, is prepared to meet any requirement for silicone ducting.

How can I make sure that Flexflyte will solve my problem?
Write us, outlining your requirements. Our engineers will be glad to put their experience to work for you. Write Dept. 202.

Represented nationally by Aero Engineering Co. and Aircraft Supply Co., and by Aircraft Industries in South, Washington.

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Special Cam Roller Needle Bearings designed for Hamilton Standard Division of United Aircraft. Do not mix with the other type. Note that lines of needle rollers protrude to face bearing housing, and long taper roller outer cone reaches to face hole by snap ring wedge.

Special Torrington Bearing smooths feathering of Hamilton Standard Reversible Propellers

Hamilton Standard's Reversible Hydromatic Propeller, standard equipment on a majority of transport aircraft, provides reversing of blade thrust for shorter, safer landings. It also enables the pilot to feather the propeller to stop or reverse windmilling on a malfunctioning engine.

Four special Torrington Cam Roller Needle Bearings help prevent "jitteriness" or "lag" in the non-feathered feathering mechanism. Their full complement of needle rollers provides the highest possible radial load capacity with low frictionary torque, permitting rapid in pitch change. These special bearings are an adaptation of a standard cam roller aircraft type Needle Bearing, developed with the help of Torrington's extensive experience in design and application of Needle Bearings for aircraft. (See advantages of the camroller, experience through years of Torrington representation on write. The Torrington Company, Torrington, Conn.—and South Road 21, Ind.)

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WHAT'S NEW

Publications Received:

Aircraft Mechanic's Pocket Manual—by Joseph A. Addams—Pub. by Pitman Publishing Company, 2 West 45th Street, New York 36, N. Y. \$1.75, 112 pp.

The available data has been prepared to explain why the various methods, processes and facilities are used in an aircraft construction.

The Physical and Thermodynamic Properties of Helium—by Jesse R. Simonson—Pub. by Van Nostrand Reinhold, LTD., 915 No. Citrus Avenue, Los Angeles 33, Calif. \$10.00, 51 pp.

This report leads to numerous currently available information in both atomic and thermodynamic form on the physical and thermodynamic properties of gaseous helium.

Physical Abilities to Fit the Job—by Bert Hansen—Pub. by Engineering Development, American Metal Lubricity Company, 142 Bedford Street, Boston 17, Mass. \$2.50, 145 pp.

Written with complete accuracy and ideas telling how to determine each worker's physical abilities, and relate them to job requirements safely and productively.

Testing of Weighing Equipment—by Ralph W. Smith—Pub. by National Bureau of Standards, U. S. Department of Commerce, Washington 25, D. C. \$1.25, 181 pp.

This publication is one of a series of handbooks designed to present in compact form comprehensive information relative to weights and measures requirements.

The Reciprocity Guide—Pub. Recognition & Transmittal Letter, 1618 New York Avenue, N. W.—Washington 5, D. C. \$15.00, 202 pp.

This guide serves as a reference for contractors of all the important information and guidance, both official and unofficial, that has been produced over the past five years, beginning with the passing by Congress of the Reciprocity Act of 1951.

Inventions and Inventions—by C. D. Fink—Pub. McGraw-Hill Book Company, Inc., 390 West 42nd Street, New York 36, New York. \$3.75, 155 pp.

A manual that will encourage any reader's in creative thinking, and provide him with the principles and methods of invention, and help him patent, protect, and market his invention.

Bearing Design—by Dr. Donald F. Wirtz, and Dr. E. A. Bensen—Pub. Mc-

Graw-Hill Book Company, Inc., 390 West 42nd Street, New York 36, New York. \$12.50, 470 pp.

This book illustrates bearing design and application from three aspects: the design of the bearing, the materials from which the working parts of the bearing are made, and the lubricant used.

Basic Mathematics For Radio And Electronics—by F. M. Goldbeck, and J. W. Head—Pub. Philosophical Library Inc., 17 East 46th Street, New York 17, New York. \$6.00, 155 pp.

The book deals with the basic prin-

ciples of three branches of electronics which many years of practical experience in radio and electronics have shown to be absolutely necessary.

ASTM Standards on Petroleum Products and Lubricants—by ASTM Committee D-2—Pub. by American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. \$7.50, 1096 pp.

This publication includes tentative and standard methods of test, specifications, definitions of terms and classifications of petroleum products with related information, and proposed methods of test.

-on the shelf

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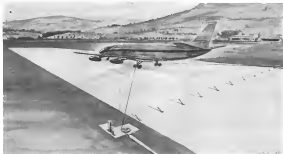
a heavy-duty efficient bearing that does not meet all specifications. It too proves to be very expensive.

At **Dean & Benson** you select no type or bearing is correct in stock. Each unit is specifically designed to meet the characteristics of the particular system and the duty cycle to which it will be subjected.

Dean and Benson can provide a bearing to meet complete customer requirements—with performance time measured in days.

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ARTIST'S CONCEPT of a jet airliner being shipped by an AE American Model 55 ocean barge and water spacer.

New Runway Barrier Design Details

By George L. Christian

Woodhull, N. J.—Giving emphasis to runway ocean barriers for military—and possibly commercial—airfields is underlined by three recent barrier developments, proposals for military applications. The systems are entirely different energy-absorbing principles.

• E. W. Bliss Co. has developed an ocean barrier for installation at Van Nuys, Calif., Air National Guard field. Equipment is undergoing final tests prior to delivery, scheduled for Oct. 1. Arresting engines are relatively small devices, measuring 5 x 5 x 2 ft. They use a pair of B-52 tanks in energy-absorbing Van engine, each with a 20-million ft/lb capacity, have been built for installation at opposite ends of the runway.

Bliss has also developed, under the



AE's Model 540 water spacer system. Inset (top) shows piston in liquid-filled tube.



work-mark of Catapult, a fully integrated concept for boosting planes into the air, anchoring them at land end trapping them so use they overtake a runway.

The system is aimed at commercial and military airfields. Ocean barrier and a land-based, stress-powered catapult were recently demonstrated at Blue testing facilities here at Woodhull Airport.

• All American Engineering Co. has installed one of its Model 144 arresting engine with an MVA barrier at its undisclosed airfield where it has been fully operational for over two weeks. Device uses the "water spacer" principle—dragging a low-friction piston through liquid-filled tube-to absorb energy.

AAE has Model 340 arresting engine in full production. Company also has a contract to install a combination arresting gear and ocean barrier using a water spacer arresting engine, at Norfolk Naval Air Station.

All American recently held a round-table discussion with representatives of Civil Aeronautics Administration, Air Line Pilots Association and the Port of New York Authority concerning the application of ocean barriers to one several airports to determine how the overall problem should be attacked.

• Van Zee Associates, Inc., under a contract with USAF's Air Research and Development Command, has developed a new "landed ocean barrier" installation is currently being made at Edwards AFB, Calif., and test tests are expected to begin by Nov. 1. Arresting engine design is based on the basic hook principle.

W. D. Van Zee, who heads the firm, told Aviation Week that the air spring engine, with an energy absorption capacity of 100 million ft/lb, was the largest ever built in this country.

Barrier was designed to stop B-47s in a landing stroke of 200-300 ft, an stopping speed at 110 kt; with a 1,000 ft stroke.

Van Zee said the barrier's arresting capacity was ideally suited for use with the DC-8 type commercial jet transport.

He has sub-contracted design and manufacture of a tail hook assembly to be attached to the back part of



BLISS ocean catapult at Woodhull, N. J. Accelerators (left) store steam to drive piston down long tube (right). Cable drives air in the long-piston.



CATAPULT simulates a 20,000-lb. decked launch. Arresting cable is in foreground.



ARTIST'S drawing shows deckball, having been launched by catapult at over 100 kt, being stopped by Bliss-developed ocean barrier. Arrow points to underground arresting engine.

FACTS

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the very same wheel assembly of a B-47's hydraulic landing gear. For it will soon be delivered to the Air Force for installation on a B-47.

STOL vs. Catapult

AN AMERICAN WEEK sampling of transcontinental airlines' reaction to overseas barriers brought these opinions: • **American Airlines**—A highly-placed company official said the airline is interested in overseas barriers, but under two conditions. One, they must be simple and relatively effective devices too, they should be installed only on runways where ocean travel would be catastrophic to the aircraft and its passengers. He did not feel that barriers were justified on runways with adequate and safe ocean exits.

As to the eventual use of catapults and arresting gear to allow large aircraft to operate from short runways, he was not convinced. He felt that more feasible ways of attacking the problem, ones that would be more appealing to passengers, would be the development of STOL (short takeoff and landing) principles and perfection of boundary layer control to give large aircraft safe short-field performance.

His lack of enthusiasm for catapulting and arresting equipment was based on a feeling that passengers would come to fear, and therefore avoid, such devices. • **Trans World Airlines**—An engineering department spokesman said that TWA "would like to see the development of an overseas barrier capable of stopping commercial transports... such a device could probably save some money." He added, however, that barriers would be measured only for runways which had inadequate overruns and/or short, cross-wind runways whose length might be critical for approaching heavy transport planes.

He emphasized that the problem was one which no single airline could tackle individually. It is a problem which will require major airlines to agree on such matters as: which airports and which runways will need barriers, what type of barriers and arresting engines are the most effective and how is the equipment, if purchased, going to be paid for? He concluded by saying that "the entire spectrum of overseas barriers for commercial air still needs a lot of development on an industry basis."

• **United Air Lines**—Carl Christensen, UAL's Director of Flight Safety, told AMERICAN WEEK that "several proposals have been made to the airline concerning overseas barriers, but the subject is larger than one company and projects remain within the jurisdiction of the CAA."

"No national policy has yet been framed up (so far), and before it can be, the following has to be determined":



BLISS landing engine single 8,100 lb., is 5 ft. high and has 20 million r.p.m. empty absorption capacity. Circular orifice at top looks hydraulic action driven by air pressure (coming from each side of the machine) through five tubes. Motor supply pressure is 8.12 bar, which stops plane. Motor at bottom starts bar.

"Type of overseas barrier installation, 'How will it be controlled by the pilot or by the control tower?' 'Who will bear installation costs?'"

Noise Reduction

One interesting remark, made by an airline about airports was that the device, in getting planes into the air quickly, could help considerably in alleviating the noise problem around airports.

A CAA official said his agency "has not yet formed any opinion concerning overseas barrier requirements for commercial aircraft."

Some conclusions reached at the recent All American Engineering sponsored meeting, held at the company's test base at Kansas City's Airport, Overbrook, Mo., were:

• **Neither aircraft manufacturers nor airlines will allow any hardware to be hung on commercial airlines for the specific purpose of engaging an overseas barrier.** • **Engineering must be accomplished with aircraft engineering in close "in a" cooperation.**

• **Overrun barriers should be simple, fool-proof, highly reliable, easy to maintain and unaffected by weather conditions such as dust, snow or sleet.** Furthermore, it should be so placed as a runway that it could be beyond the aircraft's operating zone. This would allow it to

be kept constantly in the engaging position at the ready instead of having to be moved whenever an emergency occurred.

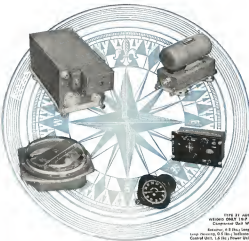
The various agencies represented at the meeting—CAA, FTA and ALPA—agreed that, from an overall point of view, overseas barriers appeared to be useful devices to protect planes from damage in case of an aborted takeoff or an over-run landing.

They suggested that All American officials submit to them for study a proposal based on the latest operating figures and takeoff and landing weights of the heaviest commercial jets now being built.

Catapult Components

Three principal components (and several sub-components) comprise an overseas barrier—ALPA decided for the military, that technicians feel this will be the list of Catapult's three components to see civilian service. They are: that such devices as United, TWA and American have expressed interest in overseas barriers.

• **Arresting Gear**—Next step will be to install arresting gear which will "bring planes to a swift, easy stop in a fraction of the distance required with conventional landing methods. With catapult-mounted takeoffs, arresting gear will permit even large, heavy planes to



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• **Catapult**—300,000 lb plane mounted by a catapult to 60-70 ft over a distance of about 300 ft. It would use half the runway an unobstructed plane of comparable weight would require, according to Buse engineers. Catapult's acceleration would impose 3-4 Gs on plane's passengers, which would be hardly acceptable and which, to provide adequate cushion, Marston, still would be straightforward and simple, since it would need to generate a towing load of only 100,000 lb. Cost would be approximately \$500,000.

This spokesman mentions a new concept as compared to IG corner catalysts, for catalyzing commercial reactions. Catalyst could be a continuous type.

Aircraft would be coupled to it automatically without requiring manual hook-up. Aircraft would tie to the catapult, be coupled and launched without the passengers necessarily knowing what was happening. As soon as our plane was clear of the catapult, the next aircraft would take its place and be launched without waiting for the catapult to be rearmoured.

Simple Catechism

His engines demonstrated a steam output here recently—one they claim is the first to be developed in this country, specifically for land use—and an electric boiler using a His-developed narrow-diameter engine, or boiler.

Both devices were demonstrated with a 30,000 lb test vehicle which was launched twice in the catapult onto the barrier at speeds of 95 and 110 mph respectively.

Domestic design philosophy of catspaw and brake jiffie was to keep it simple. Catspaw is a slingshot-like device made out of commercially available parts and operated by 2,000 psi clean nitrogen.

Steam is provided by a standard, oil-fired steam generator manufactured by the Babcock & Wilcox Corporation. A machine which takes about one cubic yard of spore, can produce enough steam to operate this particular strip-pulp about once every 15 minutes for the continuous type of operation as required in full-scale commercial use. A bank of three steam generators would provide the greatly increased power desired.

Straw is pegged into two large silos immediately where it is stored under vacuum up to 2,800 psi. When compacted is solid, straw is extruded into a 340 ft length of commercial, cold-drawn stainless steel tubing 74 in. in diameter. Straw pushes a steel piston, equipped with chrome-plated rings, down the cylinder to produce 30 mil long ft/lb of linear product.

Continuous steel cable is attached to the pulley and runs over a pair of sheaves at the head of the catwalk. From one of these sheaves the cable runs back to the test vehicle (or pump) and is hooked fast down the rear runway and led to another sheave directly across the runway from the head of the catwalk. The cable is then stretched in a big V with the apex at the test vehicle. From the sheave cable runs under the runway to the pulley. When the catwalk is fixed, the pulley hooks the two ends of the cable down the aisle after the

Smooth Accelerative

Steam is presented from cropping from the mouth of the cylinder by a heavy metal seal. As the piston travels down the tube, the cable smoothly accelerates the test vehicle to the desired speed. No brake is required because the slingshot geometry of the catapult uses the spring action of the cable testing system to generate its own braking forces. When test vehicle is launched from the catapult, cable is stretched fast because the two clamps at opposite ends of the rammer.

As a tug reports the test vehicle at the far end of the runway, the piston is returned to the firing end of the extrastroke cylinder by the cable.

Besides commercial and military air port potential, BSA officials feel that their company has some future for use

The Max developed airtight system demonstrated at Woodburn called a robot friction energy absorber—a oil compound device. Machine, which can absorb 15-mil/sec ft/lb of energy, weighs 8,500 lb and measures 6 x 5 x 2 ft. It is used as a large pit under the runway.

B-53: Newborn

Heart of the device is a pair of B-52 valves, each controlled on a computer, which open and close the large doors. On the drum is double-vented a 10-ton tub 10 ft long, 5 in. wide and 3 in. thick. As the double tube comes off the large drum, it separates. One side goes down to a stream mounted above the cages at arm level. Other side runs into a smaller drum and then goes to a stream at the other edge of the runway, directly opposite the first stream. Then, both ends of the tube empty, through this in the runway. The water is a continuous cycle corresponding to the dead point of a cotton angiotensin.

As the test vehicle hurtles into the cable, dragging it from the runway, the action tape is uncoiled from the drum. This drives two Videx positive displacement, zero-type pumps which supply hydraulic pressure to the two brakes. These slow rotation of the drum and therefore arrest the test vehicle (in place).

As the tape plays out, it reads over and



This maintenance stand for Commins/ISC-6 and T-type aircraft is built for air cleaning, painting and other high finish work. It is built of Dacron shielded against work can be installed in almost any space with the use of the built-in leveling system. Capacity is 900 lb., weight 1,500 lb. and dimensions are 38 in. long and 164 in. high. Designed and manufactured by Lockheed Aircraft Service, Inc., stand is available at \$562.00 FOB Company, Calif.



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where wheel, which actuates a special tension-actuating device. This sets to induce straining action by restricting the flow of hydraulic fluid to the hub of the plane is determining how rapidly, and provides a constant tension action to keep G's to a minimum. Put another way, the tension-actuating device automatically adjusts rotating levels exposed on an aircraft to the plane's engine speed and so, therefore, stop planes of different weights, engaging at different speeds within the same approximate distance, within certain limits.

Because use of the barrier under normal conditions would not occur with great frequency, heat dissipation is no problem.

An electric motor controls the tape and resets the entire straining system at about three revolutions. The system is reset over having to react the force of another class so often and to stop planes.

Nylon tape—thin addition to the rotating gear—drives, therefore, cable loads set up by the impact characteristics of the cable around gear and large down post-to-rotary straining loads.

The tape, made of test resistant nylon, was woven by Bion by the Plastic Tensioning Co. of Chicago. It has a tensile strength of 55,000 lb.

The straining device demonstrated at Woodhouse Airport was built for the Air National Guard and is designed to strap fighter-type planes (28,000 lb.) entering the barrier at 144 mph in a maximum current of 400 ft.

Comparing, has also built a second straining device which uses a steel cable instead of the nylon tape because it requires a current of 650 ft which is not now practical for civil type.

Woodhouse operations a major Bion's recent. Landing and Recovery Equipment Department, with head quarters at Philadelphia International Airport.

All American Approach

Robert B. Cotton, All American vice president, and his company has been situated in the problem of ocean barriers since 1943. In fact AAE designed and built one for Washington National Airport in 1946, but it was not used.

Cotton told American Wire that, after many years of extensive development, AAE's ability to provide new barrier equipment for commercial jet transports is now a fact.

Two problems are involved in the development of a satisfactory ocean barrier: what type of energy storage is used, and how to engage the aircraft. Solution to the first question is fairly routine. Cotton feels that AAE has now come up with a simple, reliable,



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a automatically controlled by progressing the tubes' shape.

Model 340's energy absorber tubes are 920 ft. long, diameter varies from 7½ in. to 42 in. Tubes are normally banded underpressure on either side of, and parallel to, the runway. However, tubes can be laid at any desired angle to the runway if the parallel position is impractical.

If possible, tubes should be banded below the front line so that water can be used as the fluid. Otherwise an air-lift must be used with no change in performance.

When a plane engages the water aspirator's piston, or other engaging device, small carbon run around runners shear to the piston so the solid-ground tubes whose ends are above water level to keep them full. The loose-fitting pistons are pulled through the tubes with the liquid creating a suction force. Only a few gallons of fluid are lost at each engagement.

Construction of the device is indicated by the fact that, as its cost goes around where enclosed run-around is 250 ft., planes with considerable weight variation (but within a given speed and weight range) have been stopped within one or two feet of the 250 ft. required.

Retrieving System

Water aspirators are provided with a simple and responsive retrieving system. A quickly detachable rope capsule is installed at the rear of each tube. During the search, the 2-in. diameter rope which is attached to the back of the piston, pays out from the capsule. After the event, a jeep or truck pulls the rope, to return the piston to its battery position. Hence, it is then detached and another capsule is attached for the next event. Normally, the retrieving operation takes about five minutes. A quicker retrieving system, which reduces to-die time to 45 seconds can be provided.

All American's model 340-A3 water aspirator unit measures about 250 ft. in length and has a 3,500 ft. run-around, weighs in about 40,000 lb. and cost is approximately \$28,500 without an engaging runner. Installation costs amount \$12,500 and can be accomplished in about 15 days without disturbing the runway. Each aspirator requires a periodic inspection of the cable and fluid level.

All American Engineering is also developing a detection type aspirator, over-run barrier under contract with the Air Force. It consists of two sets of seven stainless steel cables piled one atop the other. Bubbles are 150 ft. long, 8 in. wide and 60 in. thick.

Each of the two sets of bubbles goes through a train of 448 tubing nozzles mounted on two carriers which



F-104 Assembly Line

Lockheed F-104 Starfighter fuselages are laid out for mating to Starbuck bottles. After assembly, major sections are moved by truck to Lockheed's Palmdale, Calif., plant for final assembly and flight testing.

are dragged along the engaging engine by the plane being stopped. Called a "subtle capsule," the device was demonstrated stopping an F-54C which was pushed down a 5,000 ft. runway by its own engine plus the lock of four RAYCO bottles. Engagement was made at 140 kt. at a weight of 25,500 lb. Plane was stopped in 50 ft. Energy absorbed by the device during that particular run was 20,278,600 ft./lb.

Plane was guided along its path by a special rig riding in guide rails. Spikes on both wings kept the plane from taking off.

Model 340 Barrier

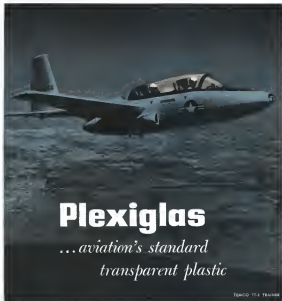
Engines at AAE, aware of the fact that different manufacturers and engine sizes are liable to hang up, hardware on commercial transports for the specific job of engaging barriers, have tried to design a system which would not require any special plane hardware.

Cable structures on a plane strong enough to resist barrier retarding forces are the wings and main landing gear. Since engaging the wings is too even, however, AAE engineers concentrated on a system to engage the main gear and developed the Model 340 barrier.

The device is made up of an engaging cable over each cable, telescopic struts, engaging cable and related components.

Telescopic intermediate struts are located 15-20 ft. apart across the beginning of a runway's crosswind area and are retracted into the runway so that the tops are flush with the surface. Engaging cable is attached to the upper ends of the struts, stretches between them at a release mechanism.

An actuator cable is tensioned about four feet above the runway, directly in to the engaging cable. A series of stretchable wire coils, having a 500% elongation factor, are attached on the upper



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end to the attitude was used on the lower end to lift the cable, which are attached to the intermediate standstays. The attitude cable is tensioned between two main standstays, one on each side of the canopy.

Operating Principle

Here is how it operates: Nose gear of an overhauling aircraft engages the attitude cable, towing it forward. Wire coils attached to the attitude cable are stretched, putting sufficient tension on the fiber wires to pull the tensioned standstays up and into position. Standstays lift the attitude cable to a height sufficient for it to clear the plane's nose wheels and engage the main landing gear struts to arrest the aircraft. Nothing about the Model 50 became apparent as special devices to be attached to the plane.

Greiner said that AAE is prepared to furnish a complete runway emergency barrier for an airport measuring 150,000 ft. with an engaging capacity of 120 kt., complete with Model 50 barriers and with guaranteed performance for 707 and DC-8 class aircraft, for approximately \$60,000 F.O.B. Wilmington, Del. Installation costs are not included.

Greiner barriers differ from the currently used anchors that devices which require an excessive amount of run-out and time to react after being used, since attached from a solid base point of view.

Whether commercial airlines will follow the example of the military is more a matter of conjecture at this point.



BRANIFF MECHANICS link propeller shaft with coupling flange to new dynamometer at airline's Dallas overhaul base. Photo taken from control room.

Braniff Using Dynamometer

Dallas-Braniff Airways has installed a dynamometer-equipped test cell at its overhaul base here to modernize engine testing facilities.

Braniff made the switch to dynamometer engine testing because it is more efficient than the older propeller-type test cell, and because it is more accurate. New installation, built by Clinton Manufacturing Co., is designed to in-

crease engine testing accuracy to one half of one percent.

Since power output of an overhauling engine can be quickly and accurately recorded on a single sector in the test cell's control room, the airline's test operators no longer have to refer to charts, curves and complicated computations to verify engine performance. Dynamometer makes testing simpler

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and when that the air propellant system, and efficiency is increased by the shorter load-up time for the dynamometer. With pump testing, engine changes in the test cell took two to three hours, keeping the cell inoperative as much as 50% of the time. Dynamometer cuts engine running time to 30 minutes.

Bentley's new dynamometer is built for a life expectancy of 10,000 hours of repeated actual engine run-in cycles. It is housed in a 40-lb square dished block housing at Bentley's Love Field maintenance base. When the surface core reinforcement base is completed last, the dynamometer will be moved to an underground test cell.

Liquefaction Reduces Bulk of Helium Cargo

Best way to transport large quantities of helium is to liquefy it at plants where it is produced and ship it in air or tank car to points where it is needed, according to Nix's Bureau.

Nix is critically concerned with the production and transportation of large quantities of helium because of its voluminous need of the gas for a variety of jobs ranging from cooling machinery to control wire and welding applications.

At the recent 1957 Congress High-Speed Conference held at the Boulder-Cole Laboratories of the National Bureau of Standards, discussion revealed several refined tank concepts capable of transporting 60,000 liters (15,000 gallons) of liquid helium. Design of the can has been worked out at the Boulder Laboratories.

Although liquid hydrogen, about 10% colder than the -269° temperature of liquid helium (absolute zero is -273°), can be transported in a special container with no refrigeration cost required, liquid helium cannot. To store large quantities of the very cold liquid gas successfully, liquid helium vessel walls have to be designed to use liquid nitrogen (-196°) rather than fluids (AW July 29, p. 58) which cut liquefaction loss to less than 1% per 24 hour period.

With such additional cooling, ten cubic liquid helium can be sealed in a transportation container for a finite number of days before pressure rises sufficiently to approach the tank's bursting point.

Operation was suggested that it is technically feasible to liquefy helium economically with an energy requirement no different being required.

Dry Vacuum Achieved With Electronic Pump

A new high-vacuum pump which provides an electronic method for producing vacuums without the use of organic fluids has been put on the market by Consolidated Electrodynamics Corp.

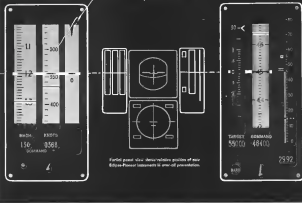
Called Evapor-Lon pump, type EI-2085A, the unit can create a dry vacuum ranging from 10⁻⁴ to 10⁻⁶ mm Hg.

It pumps active gases by the getting-around action of evaporated titanium and pumps inert gases by adsorbing and leaving them under a layer of titanium.

Continuous titanium was evaporated in a sealed but not exposed bellows mechanism. Operation is now possible for periods up to six months at a single without breaking vacuum for servicing.

This model Evapor-Lon pump has a pumping speed of 1,900 liters per sec. for nitrogen, 1,300 liters per sec. for oxygen and 1,000 per sec. for hydrogen according to the manufacturer.

No refrigerated bellows or traps are required, nor is mechanical intervention needed for maintenance operation. Pump can run for six months at longer without breaking vacuum for servicing. Manufactured by Rockwell division Consolidated Electrodynamics Corporation, 1775 Mt. Road Blvd., Rochester 3 N. Y.



Ported panel view demonstrates position of new Eclipse-Pioneer instruments in one-off presentation.

NEW INSTRUMENTATION SIMPLIFIES JET PILOT'S JOB

Easy-to-read moving-tape command concept is first step in Air Force program to ease burden on pilots

The jet pilot's job is made easier by a new reference line concept in instrument presentation developed jointly by the Flight Control Laboratory, Wright Air Development Center and Eclipse-Pioneer.

This new presentation—designed to operate from a Bendix Control Air Data Computer—employs moving tapes as one virtually integrated instrument to tell the pilot at a glance "what is happening" and "what needs to be done".

Computer control computations are eliminated. Actual and desired flight information is presented in easy-to-read, graphic fashion. Actual flight information is displayed on moving tapes against a constant, horizontal reference line. Computed information also is shown by the black and white bars. Direction of the

moving elements corresponds with the control bars. When the computed bars coincide with the horizontal reference line, desired performance is attained.

Suppose for a moment you're a jet pilot. To know what you're doing you read across the constant horizontal reference line. The instrument at left shows you are flying at Mach 1.2—340 knots indicated.

Your glance now turns to the instrument at right. You note an enhanced altitude of 45,000 feet. Additionally, the left scale of this instrument shows a 30,000 ft per sec rate of climb, while the column at far right indicates target altitude—55,000 feet, required altitude—45,000 feet, and extra penetration—15,000 feet.

The black and white command bars tell you what needs to be done. The straight bar at the bottom left is the maximum safe Mach marker.

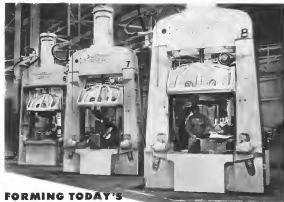
Pre-reaching signals are furnished for this simplified presentation. By indicating "head in" signals, first priority safety is achieved and chances of flight course success greatly improved. Training time, too, is reduced.

Bentley is proud to have shared with the U. S. Air Force an important role in this vital aspect—a role so closely related to Bentley's increasing efforts to be first with the best.

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FORMING TODAY'S TOUGHER, "HARD-TO-HANDLE" METALS TAKES THE **IMPACT** OF THE **CECOSTAMP**

THE CECOSTAMP provides a controlled impact blow not obtainable on any other press. The operator, by, at his fingertips, full command of the ram for sharp blows or squeeze as the job requires. This control of the blow intensity assures the correct impact and pressure required by the metal being formed. It easily forms, in a permanent set, the "hard-to-handle" metals such as heat treatable aluminum alloys, austenitic stainless steels, magnesium and titanium. There are standard CECOSTAMPS to fit nearly every requirement with working areas from 2" x 18" to 120" x 120". Stroke of ram can be increased for deeper draws if necessary.

Send for Bulletin 30-L-5.

SOME OF THE ADVANTAGES OF CECOSTAMPS

- 1. Easy shape changes of contour to permanent shape
- 2. Proforms compressions without prior dimensional draws
- 3. Shrinkage may be combined with stamping of sample shapes
- 4. Skilled operators can develop and form many shapes difficult to form on any other type of press
- 5. Controlled blow is well suited to form large or small parts
- 6. Low tooling cost and rapidity of die fabrication

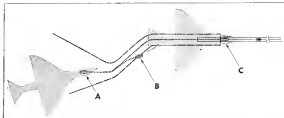


GEGOSTAMP

CHAMBERSBURG ENGINEERING CO.



CHAMBERSBURG, PENNSYLVANIA



DRAWING shows how Blue Two Guidance System would automatically direct plane to catapult shuttle. Shuttle returns slot of A, is raised and stopped in shuttle at C. If plane should run out of slot at A, it is automatically applied brakes.

Taxi Guidance System Steers Aircraft to Catapult, Stops It

Woodhull, N. J.—Blue Two Guidance System designed to store carrier-based aircraft quickly and automatically to the ship's catapults and stop them precisely at the correct position to be loaded on to the launching berths and shuttle, under development here is the E. W. Blue Company for Hughes.

System is currently undergoing preliminary testing at Woodhull Airport by Blue Aircraft Launching and Recovery Equipment Department headed by J. J. Bone, Manager Project, which was started seven months ago, is scheduled for completion by the summer of 1955.

Commercial Uses

Blue Guidance System promises to be the first representative of a new method of spotting planes on catapults, which requires a pilot to follow a line painted on the deck and also additional guidance information in the form of hand signals given by plane directors standing nearby. With the system, the pilot merely starts moving in the general direction of the catapult. The system takes over, spots the plane and stops it, leaving the pilot to handle only power.

Blue says that the system, when perfected, can be used just as well to guide carrier planes to other parts of the ship such as elevators as parking area.

From a commercial standpoint, Blue feels that the system could be used in spotting commercial freighters with precision in the congested area which so often due, plane movements would save time.

The system's full-scale feature, which automatically applies a plane's brakes to bring it to a full stop should it run out of its present path, will be beneficial for military and commercial operations alike.

This is the principle behind Blue Two Guidance System.

On the deck (or moor) are laid out a series which carry 24 V. at 600 c/sk current 180 deg out of phase. Attached to the plane's nose gear, at other appropriate locations, are two pickup coils which continuously seek the rail and point between the same. As soon as the coils approach one of the wires, they sense this fact and relay a signal to a control box. The box, in turn, actuates either brakes or nose gear steering through solenoid valves to control the plane's deviation from its intended path.

If the plane's nose gear—and these four steering rods—are outside of the rail provided by the wires, brakes are automatically applied and the plane stopped.

Also, when the plane reaches its desired location, the nose gear crosses the wire and holds the plane.

Experimental Model

Current Blue experimental model of the system is installed on a T-38 loaned by the Navy. Deck wires are attached to a portion of a recess in the Woodhull pier.

In three successive demonstrations, TGCS steered the T-38 safely into the desired position and stopped it at the

marked end of a catapult pointed in the moor.

Steering action tended to be jerky, in spots. Blue engineers explained that this was partly due to the developmental status of the equipment, and partly to the fact that the plane's right wheel was sticking.

Another factor contributing to the slightly uneven steering action of the T-38 is that its gyrostic steering is accomplished through valves which pulse five times a second and retract the busbar. Simultaneous operation of later equipment will be assured by use of proportional valves which will apply brakes to steer the nose wheel in direct proportion to displacement.

OFF THE LINE

First details have been issued by Britain's Royal Aircraft Establishment of a hydraulically-powered guided slide drive which operates at a pressure of 4,500 psi and has a stall torque of 1,500 ft. Four of these drives are incorporated in a long service vehicle in diameter as a guided mobile test vehicle for wing control surface operation. Portion of the device are the high pressure output obtained from single stage hydraulic amplification and maximum speed of response of 1,180 deg/sec.

Hydraulic constant speed drive for 15 hp, zero slip alternators which can be used in reverse to drive the engine for starting when the alternator is engaged by a starter motor has been developed by Ingersoll, Ltd., Wokingham, England. The constant speed drive delivers a constant 5,000 rpm, held within 1%, with input speeds varying from 1,100-11,000 rpm.

Manhour Investment High on Sparrow I



SPARROW I employs combination of simple inertial and beam riding guidance. Beam darts after launching, gives and accelerometers stabilize flight path and guide into radar beam of interceptor which is aimed at target. Once beam has been penetrated, action as the missile proceeds by up, down, left, right signals to guide to beam center.



SPARROW I attacks radio-controlled B-17 drone with precision beam guidance.

Cost Neck, N. Y.—Nearly four million engineering manhours were expended over a 10-year period to bring Navy's Sparrow I intercept missile from aerial concept to operational use.

Like figure in several lines, greater time spans for development of World War II bombs and only positive jet fighters.

The high engineering manhour investment required to produce Sparrow I reflects the inherent difficulty of trying to produce the features of an automatic interceptor in a 125-foot-long, eight-inch diameter package. It also reflects the fact that 16 years ago there was little previous experience in the missile art and there were practically no available component parts or devices that were small enough and reliable enough for missile use.

Appearance Deceiving

The Sparrow's small size and external simplicity are deceiving indications of the amount of effort required for its development and design. More than two million engineering manhours were expended by Sperry Gyroscopic Co. in development and evaluation experience.

That includes more than 100 prototype missiles built and flight tested between 1946 and 1951. (First at launching from Navy aircraft was made in 1946, less than three years after project began.)



QUEER SPARROW fits snug under wings of McDonnell F2H-2M. Missile is in use with Seahawk.

Another 3.6 million engineering manhours was spent in bringing the Sparrow I into production, including much time in development of test equipment, integration of missile with the intercepter fire control system with which it would be used. At least an other 8.4 million engineering manhours were spent by major Sperry sub-contractors.

At the peak of the program, Sperry had about 300 engineers assigned to the Sparrow I.

The 125-foot-long, eight-inch-diameter Sparrow I weighs about 500 lb., ac- cording to its top speed of more than 1,930 mph. It is carried externally under wings of Navy interceptors such as

Douglas F3D-2M, Chance Vought F7U-3M and McDonnell F2H-2M.

Guidance, navigation, counting of base band full-scale stability and four variable conductance wings located near C. G. for control, permit up-down, left-right maneuverability without banking maneuvers.

Guidance System

Interceptors fire control system radar, which enables pilot to maneuver into firing position, also serves to guide the Sparrow I to the target. Immediately after launching, a simple inertial guidance system in the missile (consisting of multi-rate gyros and accelerometers) stabilizes missile flight path and keeps

Sparrow I into the beam of the intercepter's radar which is aimed at the target.

Once missile has entered intercepter radar beam, Sparrow's initiating radar receiver determines missile's position relative to center of radar beam.

The specific techniques employed to determine this displacement are not disclosed.

Computer circuit modifies the missile displacement signal before it is used to operate solenoid valves which in turn control flow to hydraulic actuators. These duplicate variable conductance wings to direct missile toward beam center.

Beam ride technique used in Sparrow I generally is considered to be less



BEST POSITION indicates that intercepter radar may launch only projectiles of Nos. 1 and No. 2 variants.



THE PITIFUL PLAIN OF STANLEY ST. SAINT...

(please translate verse now easily later)

The previous party was going full blast
And the bewitching hour had long ago passed
The voices grew louder with each passing minute
While the singers of songs ran their heart and soul in it.
Then Stanley St. Saint arose with a hush
And climbed on the piano to procure a perch.
"Why all, he said, voice choked with emotion
"That all of these parties are for someone else's gratification!"
In the ensuing silence there wasn't a peep
Even when Stanley collapsed in a heap.
The next morning Stanley was filled with remorse,
But how late he was asked (with such joy, of course)
MORSE: Don't be like Stanley and waste all too late,
Get in touch with Kaman and set up a date.

KAMAN

THE KAMAN AIRCRAFT CORPORATION

71 Windsor Road
Mansfield, Connecticut

I'm sandy, here's my resume.

My engineering title is _____

Name _____

Address _____

City _____

State _____

*Any reference to person living or dead is strictly coincidental

systems than self-contained radar guidance employed in Sparrow III. The reason is that beam rider guidance sensitivity decreases as range gets longer, due to increasing width of interceptor's radar beam. Guidance sensitivity of waveguide carrying over radar improves as it nears its target.

Another disadvantage of beam rider guidance is the fact that interceptors must keep its radar aimed on target until inside strikes.

However, beam rider guidance generally involves less waste complexity—no important considerations in missile guidance systems. Also, it is possible to employ more sophisticated anti-jamming techniques in interceptor's radar than in small missile radar, making the former less vulnerable to enemy countermeasures.

Propulsion and Warhead

Sparrow I uses solid-propellant rocket motor which, like the warhead, is produced directly by Navy from its manufacturers, later assembled into Sparrow-built subassemblies at Naval field installations or aboard ship. The Aerojet-General rocket motor uses high-thrust propellant consisting of electric grains with plastic bond.

Ballistic guidance agent provides burning rate that essentially is independent of altitude.

Propellant is fired by electrically operated igniter, triggered from the interceptor cockpit. Safety and arming or even permit live motion to be stored and handled safely at shore installations and aboard ship, Sparrow says.

Warhead, which represents a significant portion of missile's weight and volume according to Sperry, includes usual safety and arming mechanisms. Warhead fuse is presumed to be of the proximity type.

Reliability Program

Sperry, Fenget Co., division of Sperry Rand, was engaged in June 1951 to build, equip and operate a Naval Industrial Reserve Aircraft plant near Bristol, Tenn. to manufacture the Sparrow I. (The \$17,000 sq. ft. plant was turned over to Bendishon earlier this year to build Sparrow III.) Management and engineering personnel from Sperry Rand formed the nucleus of the Sperry Fenget operation at Bristol.

To achieve maximum reliability, 99%

Sparrow Avionics

Avionics guidance and control equipment in the Sparrow I represents more than 75% of its total cost, with software and structure amounting about 121%—propulsion about 61% and warhead about 34%.

Thunderbird Battery Model



Model field installation shows English Electric Thunderbird ground-to-air missile on launchers with assembly and test station at rear and radar and control console at right. System was designed to use standard British Army trucks and vehicles and require a minimum amount of special equipment.



Modules are delivered to assembly site in containers (above). After assembly and checkout, modules are delivered by truck-ships daily to launchers (below). Model layout was shown at Fort Monmouth. Thunderbird test models have been fired at Woomers, Australia before 1955.





TACAN unit shown with cover removed, above is a composite model.

tube 78-page road map for jets

An 880-foot corner may be as hard to find as a needle in a haystack, when the plane seeking it is at 20,000 feet and the time is 0200 hours.

To make the homing phase a homing pigeon, we built the "ARN-93" TACAN equipment illustrated above. Its 78 tubes and associated components add up to a self-contained transmitter and

receiver, rugged in its resistance and accurate to pin-point tolerances.

The manufacture of equipment so important and complicated as this demands perfection, and nothing less. On the military as well as the home front, Stromberg Carlson has long displayed the ability to take such problems in stride.



STROMBERG-CARLSON
A DIVISION OF GENERAL DYNAMICS CORPORATION
Circle 50 on Reader Service, R. T. West Coast plant at San Diego and Los Angeles, Calif.



Bryan Leaves WADC

Baltimore, Md.—Major Gen. Thomas L. Bryan, Jr., who recently underwent major surgery and is scheduled for a long convalescent period, stepped down last week as commander of Air Research and Development Command's Wright-Patterson AFB, Ohio.

Gen. Bryan was replaced by Brig. Gen. Stanley T. Way, former chief of the Electronic Defense Systems Division of the Air Materiel Command's Directorate of Procurement and Production in New York City.

Gen. Bryan is expected to return to full military duty immediately after his convalescence.

Recent test-to-operation work has focused on all functional system components, such as sensors and computers. Even tube was subject to microscopic inspection and was electrically tested both before and after a combined burst and vibration test. Final inspection of assemblies was completed as a 2000-ft test, with additional testing by supervisors to check on inspection performance.

Sparrow Subcontracting

Preliminary reporting of field failures was combined with extensive data processing to rapidly locate and correct reliability problem areas.

Stable portion of the Sparrow I production was subcontracted. Sparrow reports, with more than 90% of failures related going to major subcontractors, another 15% going to various smaller vendors.

Sparrow Read Corp., which developed and produced Sparrow I, calls it "the first air-to-air guided missile in the nation's inventory," a claim which might well be controverted by the Air Force on basis of the Hughes Aircraft Co.-developed Falcon.

Sparrow I, which has been in operational use for several years, reportedly will continue in this status for at least several more years. Successors will be the Sparrow III, developed and produced by Raytheon.

Air Force Activates First Missile Division

Castle AFB, Longview, Calif.—Air Force has activated its first ballistic missile division headquarters here to plan and prepare for future operational ballistic missile units.

Designated the 1st Missile Division, the unit will have overall supervision of USAF's ballistic missile training program and will establish the overall operational capability of the missile. Gen.



Missile Test Stands

Stands on Andrews Ridge, Edwards AFB, are used to store test complete intermediate range and atmospheric ballistic missiles. Note silhouette of missile on its rail-edge stand (middle) and mobile model (bottom) which resembles drawings of Gemini Atlas.





"Wacky idea" high altitude research balloon being launched from a ground platform under an AFMDC. This balloon carries instruments to study upper atmosphere. Data is sent to the ground station via radio link.

SCIENTISTS ARE OPENING DOOR TO OUTER SPACE AT AIR FORCE MISSILE DEVELOPMENT CENTER

Almost 4000 square miles of desert comprise the center and much of the rest of the Air Force Missile Development Center at Hottelville, Ariz., near Alamogordo, New Mexico. In another sense, the test range is a frontier, extending upwards to the reaches of space. It is one of AFMDC's missions to extend our knowledge of those extreme altitudes, to prepare man for life above the atmosphere—thus in addition to extensive development and test work with missiles and their weapons.

AFMDC is one of the centers of the Air Research and Development Command. In addition to its basic mission, it works with other AFMDC centers, government agencies and industry on such areas as electronics, weapons, and upper atmosphere research.

Outstanding tests at AFMDC are surface tests and tests in an experimental facility for testing high altitude aircraft, as well as surface tests, surface-to-surface guided missiles, and other missile weapons.

Scientists and biological specimens are carried aboard in experimental rockets and balloons at AFMDC. An studies of radio wave propagation at high frequencies, investigation of electrical characteristics of the ionosphere and composition and ionization properties of upper atmosphere, studies of the activity of satellites from the ionosphere, and studies of the earth's surface of high altitude winds, and studies of the biological effects of cosmic radiation and related activity. This high altitude research is useful in the development of weapons, aircraft, and associated equipment.

Gleaning this useful information is a long and difficult business which demands the skills of thousands of civilian and military engineers and their many counterparts in private industry. The efforts of this small army of technicians will not only determine America's ability to meet potential aggression, but bring even closer the coming Age of Space.



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DIVISION OF SPERRY RAND CORPORATION

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Circle 145, Col. • Dept. 100



Technician at Ford Instrument Co. is working on a piece of electronic equipment used in the development of high altitude research.

ENGINEERS of various abilities can find a place at FORD INSTRUMENT CO. Write for information.

SAFETY

CAE Resolves Pilot's Rating in:

Case of CAA Administrator vs. Specht

(Following is the full text of the CAA's opinion, order and dissent in the case of CAA against TWA Capt. [named].) Specht was released of Civil Regulations (14 CFR 61.15, p. 105). Capt. Specht's appeal was pending in full before the panel (121).

The proceeding involves a complaint filed on Feb. 19, 1957, by the Administrator of Civil Aviation against the respondent, [named], a TWA Captain. The complaint alleges that respondent committed various violations of the Civil Air Regulations and constituted a risk to the public safety. The respondent's appeal was pending in full before the panel (121).

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Initial Decision

After due notice, a public hearing was held before the Administrator, J. Thomas Smith, on Feb. 20, 1957. The respondent, [named], was present and testified. The Administrator's initial decision was that the respondent's appeal was pending in full before the panel (121).

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Section 61.15 of the Civil Air Regulations, (14 CFR 61.15) provides that the respondent's appeal was pending in full before the panel (121). The respondent's appeal was pending in full before the panel (121).

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Revised Decision

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Increasing Cognition

In view of the increasing number of cases involving the respondent's appeal was pending in full before the panel (121). The respondent's appeal was pending in full before the panel (121).

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Six of the Lockheed models were the flight tests T29-1 jet trainer, NF-2 radar search plane, F-104 jet fighter, H-93 Starliner reconnaissance helicopter, WC-130B aircraft carrier, H-93A maritime patrol bomber.

Flight Test Engineering – *the dynamic field for engineers*

A statement by H. S. Thayer, Chief Flight Test Engineer, California Division, Lockheed Aircraft Corporation

The technology of flight and engineering depends on concepts of spatial vision and attitude.

There are always a large number of aircraft demanding the agency of professional flight test engineers in a company as diversified as Lockheed. At present there are 36 aircraft—13 different models—on hand for extensive flight test engineering. In addition, the Kinetic programs, small jet transports and other significant projects will soon swell our vehicle list.

A single, tight test effect, such as this call, is an exception: who is flexible, able to cope with changing assignments that vary widely in complexity and approach. He must be able to continue on his

launched a growing of buckhead a new dashboard light and engineering and

free, the *Architectural Record* is out-of-phase in its dependence on a field of rights to tell *Whispering*, he must possess identity in himself like a co-processor in a single phase of engineering. His consciousness comes to the surface through *Architectural Record*. And in *Right* writing begins to produce a design under one philosophy of engineering, he produces actively in *Design* and development of all Lockhead records from that stage through completed writing. Needless to say, a light text background in Lockhead helps qualify an engineer for virtually one line engineering machine in the computer.

Our experience program has created new positions for Flight Test Engineers, Flight Test Analysts and Aerodynamics Engineers with these activities. Many of the positions are on a senior level and will particularly interest engineers with flight test experience. I have asked E. W. DeLozier, manager of our Placement Staff Dept. 3300-1, to give you literary help in finding openings.

were hardly going to give Speer's machines, but to permit the machines to do nothing instead at impact, as because of delayed firing upon voice reflection, is a guaranteed road to disaster.

It behooves the Board to affirm its right to rehear and to do so for the basic principle of the complaint (Paragraph 7) and if that respondent was careless and that he lacked responsibility must fail. There is no doubt that the examiner's conclusions on this point was predicated upon IWA going through Capital II's alternate. The point here is, and it is worth repeating, that Specht and every other pilot must have the right to say that those in charge of traffic control will properly perform their duties and function.

8 THE TRANSFORMATION OF THE
EMERGENCY AUTHORITY DOES TO THE SUR-
FACE OF THOSE

We agree with the examiner that the applicants are not obligated to read "The Examiner's Remarks" in order to understand the burden of proof. Admittedly, it is important to an air safety. We disagree with the examiner when he states that C/VR 502 and 40-600 mandated definitions so that a relation of these sections, adds the burden of proof of the pilot. Since the Board's instruction, the burden of proof on these cases has always been with the applicant. There is no support the examiner's "misleading" interpretation in the regulations themselves or in the Board's decision. And to accept the examiner's thinking of the burden of proof we would do violence to the process taken in our present system. The examiner is equivocating that the charge that is proof is in the charge.

C. THE EMERGENCY STATE MAY BE IN-
FLUENCED BY THE AUTHORITY OF THE
FEDERAL GOVERNMENT.

The third source misapprehension of the emergency authority probably stems from a failure to realize the statement's severe practical import.

The examiner clearly has a misapprehension that a pilot is under a duty to explain why he is at an emergency and to advise all concerned of his nature and apparent intentions. In fact, the law before him requires that he remain silent.

It is true, however, that a pilot is under a duty to inform his fellow pilots that a "special reason" must be given. And Mr. Hillman, the defendant's expert witness, is a true Mr. Healer in talking about a pilot changing in altitude under stress as an emergency, but Mr. Hillman, for all his expertise, is not familiar with the emergency authority.

[illegible]**Roscoe Green**

It is possibly evident that anything
Nacht might have communicated to the

Center as to the 'why' of his emergency would have been a rare and useful story. Moreover, Sportz and his copilot, Flight Officer West, both were born in this Irish county that they did inform the Center that it had scrambled. The examiner to the military commission was something less than perfect in this account. The error of the examiner here is in demand as a poor explanation of an emergency and, in the interest of public safety, the Royal must accept the responsibility.

The course has accepted the Administrative Interpretation that the emergency authority can be obtained only when it is demonstrated that immediate action was either imperative or was. The emphasis goes on to remark what he terms a "perfect emergency." Thus, of course, in an epidemic and probably results from a lack of understanding of the public position. The holding can only mean that the emergency authority is vested in the state and not in the individual, when there is an epidemic, and that when there is an epidemic, security and, of course, in a good sense, protects the means until the work has already happened. CARs 9030 and 9031 are fully revised. The Board must act after the misunderstanding to prevail.

Pilot Reaction

It is submitted that the resources are not actually altered, if not completely withdrawn, the emergency power of the pilot as it has been commonly understood. Yet he does not seriously believe that a responsible airline pilot would hesitate to exercise his emergency power when it is called for because of the reluctance of a pilot to be second-guessed. There again, there is a real

In a life and death situation, reasonable men would not question that the victim



Bell 47H-1 Slated for Antarctic



California Division
LOCKHEED
AIRCRAFT CORPORATION
BURBANK, CALIFORNIA



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THE ELECTRONICS DIVISION
GENERAL MOTORS Corporation

Plant 2, Mich.

*Chrysler 2, Wis.

stated that the witness is referring to air on the leading edge, the second was in response to "would you stated the craft as having a lead of air" (the "if" in Spick's answer obviously refers to the same aircraft).

The witness's additional support for his conclusion on this issue is obscure and any available and strongly worded "no opinion" response* that he issued as would not exist. All in all, the witness's opinion is the best evidence of second guessing, as would present.

There is a statement in reference to the failure to obtain the needed clearance yet that it was not sufficiently clear in the complaint nor was it put at the Miami state's case. In a footnote it is stated that this failure is an indication of Spick's lack of concern for officer records, he is not referring to VFR conditions are familiar to the Board. The confusing point here is that neither the officer states there was an other aircraft in the area. The tape transcription and the record fully support this.

Opinion Unleashed

It is not clear why the opinion is considered with the fact that Captain Spick was carrying his captain's authority and responsibility and the fact that everybody was doing his job (consequently the fact that Spick lost confidence in the abilities of his crew).

We're rather doubtful for the moment trailing missing the engine and plane performance and that we are opposed to the possibility of engine failure, lack of control and the fact that the aircraft was in a state of emergency.

We don't expect the argument that "fortunately Captain Spick did not crew and passengers are not black statistics today because Spick had the communications were to investigate these flights. The statement, as best of it, how the Center has also been repeatedly considered. Actually there is no little difficulty in using this fact that it was because of reaction points in the opinion where evidence, accepted by the examiner could only come from the pilot involved. In fact the 15 pages plus the report are fairly superficial in the other areas, evidence is not to be believed.

In part at least, it is not properly sufficient the condition, it is necessary to report the testimony of every pilot not to make something the circumstances were, Captain Spick's flight was a serious affair and it has not been done. Therefore, we suggest a reading of this testimony will considerably increase Captain Spick's action. As long as this will be done, we suggest that a full disclosure has been made. If evidence was to be more highly and not describe the plane as encountered, still, even as a single failure, why confirm that the witness "handheld" witness" might not be so.

On Instruments

But this is not enough as order to report that finding we must consider the situation.

Usually the primary observation of an operator at one point (often receiving) conditions.

"We think the instrument section has been considered. It is not of importance. It is stated that VFR is not a relevant finding. Therefore, the instrument section must be considered. Therefore, we must consider the instrument section."

concluded fact that Spick was (and partly an instrument). In addition, it is known (and understood) that at least four (of six) were in Cleveland and not used the weather data would show only Spick to 10,000 ft and from Cleveland west they would become better with the hours on the 10,000 ft. We also know from 10,000 ft up there were seven-up to 100 knots-headwind. The distance from Wilkes Barre to Erie is approximately 117 miles or roughly about 115 minutes flying time. To support this finding it is noted that to answer that Captain Spick, a cruise on low speed, 17 miles with TWA, with a total of more 10,000 hours and 2,000 instrument hours did not want to fly an additional hour on instrument and instead preferred to go up to an altitude

with extreme turbulence. There are several reasons from the opinion that give some context.

The "Minimums" section, Captain Murphy was a certified and has flown both the Lockheed Constellation and the Vought tailfin that he place a Vought, his last in the wings and that it is not much of a problem, as it is on the aircraft is Constellation with clear boots. The examiner stated that Captain Spick considered a very important aspect of the fact he failed to point out that, in answer to his own question, Murphy had his head wing and following approach on.

Reports Locking

Of course the stage where why Captain Spick did not remember the wing conditions is



Edo Loran installed in Boeing 707s. Compact console as left, right in right of case showing about for pilot operation.

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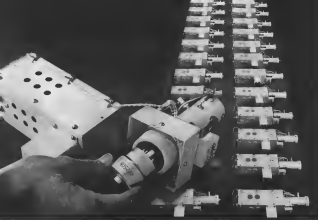


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	TV	AM	SSB		TV	AM	SSB
0-5 Plate Ratings	2000	1200	3000	Screen Description, watts	12	8	12
0-5 Screen Ratings	300	300	400	0-5 Screen Ratings, watts	5	5	5
0-5 Grid Voltage	—	250	250	Plate Description, watts	250	300	250
0-5 Plate Current, ma	250	250	250				

the customer is not close as to its meaning and criticism are well given.

Review

Famously a trio of fast facts has faded upon the observations of the discoverer and discoverer of the entire three has followed on the trail. The conclusions are spread are generally unfounded. This of course is neither a, of saying that Speedy passed himself off as the know. However, the customer is extremely critical in spreading this matter. On the contrary that is making suggesting the lack of evidence in believability of Speedy and accordingly Last Office "One and to a team retreat, Right before the end. In fact the customer put much evidence in his observation of Speedy. Of course these observations were made at and during the trial. His decision, when carefully examined, does not add your Speedy's believability but on something the customer calls "believe heard" (knowing Speedy) to be under preparation.

The true loss of customer's decision is the probable and definite evidence. Based on the conversations between Captain Speedy and the Center which happened at the time of the episode and which indirectly reveal the words and words of the patient.

However involving their statements may appear in cold type, they come in reality either the mission is what they are delivered on the basis of voice as played.

During his words of the mission in which they were delivered makes it evident that Captain Speedy was confident and in an easy mood. There is no right-hand observation in the transcript that Captain Speedy was in an emergency situation or had any other purpose than to obtain a preferred attitude.

Prejudgment

The customer goes on to state length in a room which would let and let conclusions in a last of fact which is not still tonight. This tonight is to say that it can leave but our conclusion. Because of the customer's personal opinion and can evidence publicly which is not the facts of the case, the customer prejudged the case and perhaps unconsciously created a confusion which makes the case appear, even allowing for the inevitable shading, a complete misstatement. The weight is that a learned customer had never heard Speedy on a tape transcription previously and lacking that he had no criterion in which to judge a "good and bad" case of the transcription house.

This is not to condone the acceptance of the demonstrative force of voice as heard in at least a more correct tape recording with the microphone and electronic reception facilities that will determine the state of mind of a pilot in an emergency situation.

After a similar case would not expect a microphone pilot as Speedy in the situation in which he was in to be in a "bad and angry" mood. The situation we had and was getting progressively worse.

It is not getting out help but only confusion from the Control Center. The tapes are a part of the record. The Board is free to listen to them and we suggest that a hearing of these tapes will indicate that Speedy was speaking in a steady low

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over and the excited about friends' pitch was that of Controller Boyle from the Le Grand Center.

Right to Rely

If Specht could not go down by early observation, we to go up. Now 4812" is illustrated by four examples of which only (1) at (4) are applicable. But (2) cannot be used here in this way not lack of vigilance as the part of the pilots. They had every right to rely upon the Control Center to carry out their primary function of clearing the runway. Similarly (4) refers to proving and it could not be extended to cover the facts before us as none of the specific regulations, 144.151 covering clear proximity that creates a collision hazard. Captain Maupin or Captain (1) is the "intermediate" but does not indicate in this case. There is nothing there that is even lost at any way that Maupin had to alter his position at flight when TWA 19 came through 15,000 ft. While Maupin stated on the radio transcript that TWA 19 wasn't more than a mile away, it wasn't clear enough in that any of the readings as the plane could be seen.

The Administrator by not allowing a reduction of 50 FT. has confirmed he would have been unable to prove the same proximity of an aircraft that would create a collision hazard. Certainly this is not the proceeding to show evidence what cannot be done directly.

Although the Court of Appeals for the District of Columbia has given the Board the right to pursue plans for violations of CMB under the provisions of Section 608, it is not understanding that the board has never been properly presented nor argued before this board. The question of law, although not finally settled should perhaps be argued elsewhere.

This Board might well consider the effect upon its other remedial functions as well as its primary duty which provides highest degree of safety. On the matter of policy we find the Board of an even sensitive should decline to hear penalty reduction cases because of the desirability of a spirit of high-level national cooperation between the men who fly the nation's airports, and the agency entrusted with the responsibility to promote the highest standards.

In other words it is difficult as a practical matter to hold the Board in one hand and a bracket in the other. This Board concept is based to include the Board in its primary remedial functions.

We would further suggest that the Board reconsider and require an examination of the means where there is a question as to his qualifications or fitness. This seems to us to be fundamental, otherwise there is very little sense in examining them for their first application for a Certificate as well as the conventional checks that they must take thereafter.

Penalty Hush

If we accept especially all of the findings and conclusions of the Board, Decision, we suggest that under these circumstances there

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AIRLIFT WEEK, September 23, 1957

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Fifth Iberia Super G

From Spanish Airlines' order of five Lockheed Super G Constellation has been completed with delivery of the "Fifth de Mayores" marked after a year in the annual production of Columbus. Other Iberia Super Gs have been made of the company's design. These will be used in transatlantic service with scheduled time of about 12 hr. Madrid-New York.

As a result and therefore possibly that it is completely out of line with the facts or values. It is also not in keeping with the fact that long practice (which we have been led to believe is a very important concept of the Board). With one single exception we are convinced of analogous factual data time where a penalty is given as the one that has been imposed on this one.

Also there is strong indication that Spanish wasn't given the benefit of his close state.

We are unable to find statutory authority for the Administration of Immigration to suspend a visa for the Board's examination. We believe the principle of Law v. Calk (C.V.D.C.) 215 Fed. 2d, 990 also applies.

It is here as well as the analogy that it is least in contrast to the fact that the passenger cannot appear, particularly in a case when he has already provided in the extent of a series of similar conditions.

Conclusion

We expect that time has not progressed as to make the same issue resolved here with this detail we believe resolved. The request for an extension of time for the Board to July 1 was not a matter of expedient but necessity. Nevertheless it is evident that the request never has been denied or refused and as the Board made the order record with its usual policies concerning this is no doubt that the complaint against Captain Sperry will be dismissed.

It is evident that the administration and supervision of the emergency authority be collected. It has been this time and the principle of release is established and the burden of proof is on its evidence position and the nature of the problem is clearly set in its statutory perspective, thus it will become quite obvious that Captain Sperry took the case and each action upon it.

The Board Decision therefore should be rejected and rejected and Captain Sperry's record must be cleared.

We believe that the substance of this case can be fully presented and by oral argument and we request a hearing before the full Board.

Respectfully submitted,
GORDON F. SPERRY
Attorney for respondent
Lieutenant J. Sperry

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Washington—Naval's major accident rate in carrier landings reached an all time low of .97 per 1,000 landings in Fiscal 1957, compared to 1.75 for the previous year.

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hours as compared with 1.11 in Fiscal 1955 and 1.53 the year before.

Killstions totaled 345 for fiscal 1957, a 15% drop from 405 in Fiscal 1956. This is a rate of 81 fatalities per 10,000 flying hours.

Total of major aircraft accidents was 1,195, a 10.1% drop from 1,445 in Fiscal 1956.

Major contribution of single deck and narrow landing pattern were evident in a breakdown of figures for carrier landings. Rate for single deck carriers was 97 per 1,000 landings—the same as the overall figure for all carrier landings. Rate per 1,000 landings on small deck carriers was higher—1.1. For landings in which the carrier system was used, rate was .79. Without the carrier, rate was 1.1. Marine air used only on single deck carriers.

In addition to single decks and the carrier system, Navy credits its extensive safety campaign for decreased accident rates and points out that record here has been achieved in spite of continued loss of experienced personnel and increasing complexity of aircraft.

Even though accidents are down, higher cost of more complex aircraft is being felt acutely. Total dollar loss per year from accidents is now running about \$287 million, up from around \$231 million a year ago.

Average cost per crash is approximately \$221,000 for Fiscal 1957, compared to approximately \$160,000 for Fiscal 1956.

Roughly half of the accidents occur on landing, a little less than a quarter in flight, slightly more than 10% on takeoff. Other classifications, in order, were: taxiing, wave off, auto-rotation, engine run-up and undercarriage.

In takeoffs, 90% of the pilots reported problems below 400 ft., and 57% occurred when the speed was over 300 ft. Breakdown by altitude shows 56% serious accidents above 5,000 ft. and 75% serious accidents below 1,000 ft.

Human error played some part in 51% of the total accidents for which a cause could be determined. Total of 245 accidents in Fiscal 1957 lifted 343 fatalities and seven civilian personnel. Cause was undetermined in 102 of the 245.

Pilot error was listed as the primary cause in 94 of the 245 accidents, at 39%. Pilot error also was secondary cause or a contributing factor in 13 others.

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